APR - 2 1934

ELECTRICAL WORLD

Our Co-operation With the T. V. A.

W. L. Willkie
President Commonwealth & Southern Corporation

▼

Power-Factor Correction in New England On a Benefit-to-All Basis

▼

87-Kw. Home of Tomorrow Points to Higher Energy Use

▼

One Breaker Acts for Many Feeders With New Fault Transfer Switch

▼

Selective Filter Protects Relaying But Reduces Interference Troubles

March 31, 1934

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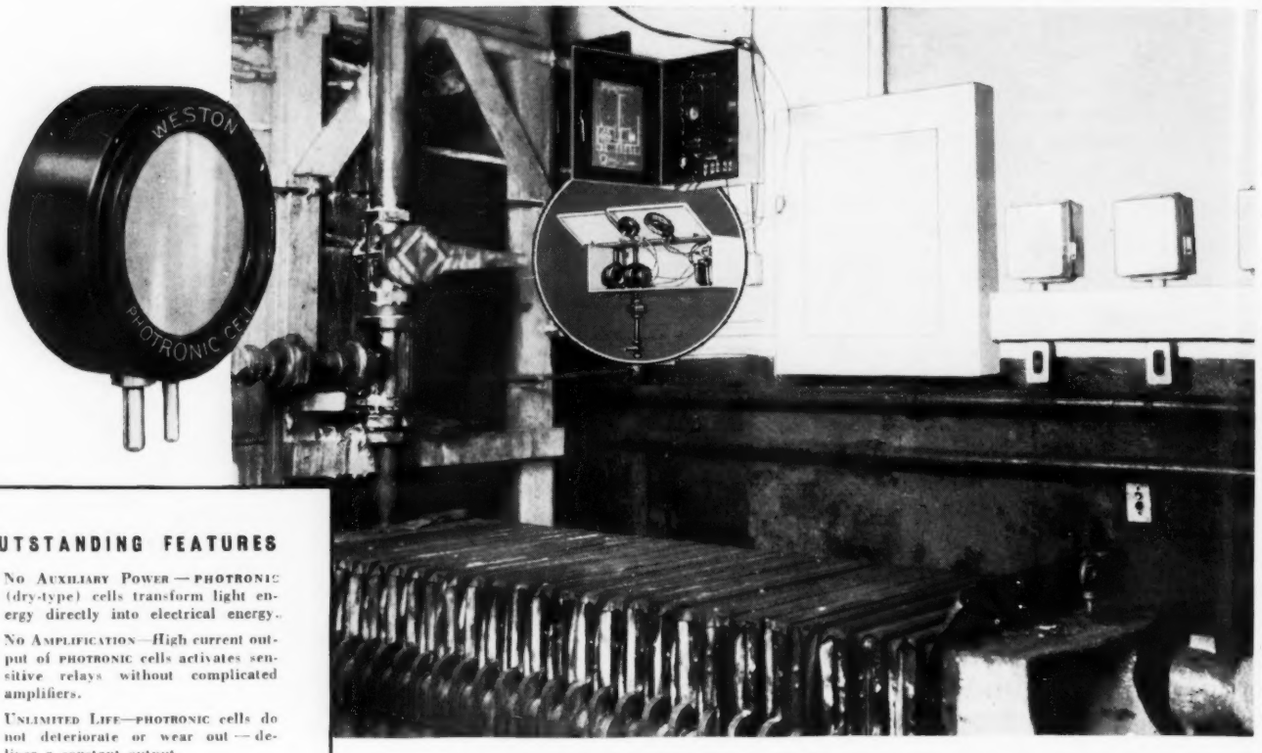

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ELECTRICAL WORLD

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What in the World!

Just look at energy production these days! This means more income, more buying, more development. First quarter reports of electric utilities and of electrical manufacturers are going to be very encouraging.

•

And the P.W.A. has allocated $28,375,200 to 49 light and power projects of a municipal type with about $15,000,000 of this for two projects in Nebraska. This sum is nothing to get excited about so far as these expenditures will affect private light and power companies. But these items mean business for electrical manufacturers.

•

The St. Lawrence will flow to the sea unhampered for a while. The Lehman utility bills are facing effective opposition in New York. The administration has faced a major labor crisis. All this gives a breathing space for the electrical industry to attend to its business. There has been much smoke but little fire. Now let's get down to business and sell products and services.

•

Code hearings for utilities and manufacturers are held in abeyance until work is done by the big three committees of industry. The administration found industry belligerent and stubborn instead of mild and acquiescent. While the battle of Washington rages we hope electrical industry groups will not abuse code privileges. We hear too much of price increases and collusion on prices. Watch your step.

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ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

March 31, 1934

L. W. W. MORROW, *Editor*

Municipalities Underwrite the Yardsticks

JUST what is proposed in the government's power-enterprise yardsticks, of which the Tennessee Valley Authority is the furthest advanced, should be thoroughly understood by all interested in the ultimate destiny of the electric light and power business. Reduced to its essentials, the most important development is a phase of that all-industry-wide problem—distribution of products or services and the most thoroughly satisfactory manner of securing it.

When it is proposed that low retail rates be put into effect, the municipalities, and not T.V.A., face the losses involved. For T.V.A. acts only as a wholesaler of electrical energy; other yardstick projects will be placed upon the same basis. In the average light and power system 50 to 60 per cent of the capital investment and about 70 per cent of direct operating expense are required for distribution or retail operations. It is well known that direct operating expenses alone average $12 per year per customer in such retail operations. It is obvious that a saving of as much as one cent a kilowatt-hour on production or wholesale prices could permit of little reduction in retail rates, since the bulk of the fixed and operating charges are incurred in retail operations.

Unless some one can increase use enormously or reduce distribution costs on an equally grand scale, all that the low retail rates specified by T.V.A. can do is to put municipalities deeply in the red and force them ultimately to increase taxes. For example, a town with its own municipal plant and a rate of 5 cents for the first 50 kw.-hr., 3.5 cents for the next 50 kw.-hr. and 2 cents for all excess might collect a gross $90,000 a year for residential service. Under T.V.A. specified schedules this revenue would be cut by $25,000. The normal production cost of energy in the municipal plant should be about 9 mills; the wholesale rate from T.V.A. would be 7 mills. Where could $25,000 be saved over present operating expenses? Tupelo, it has been estimated, may save $17,000 a year on its wholesale purchases from T.V.A., but, without any increases in retail sales, will receive $48,000 less from service revenues. A net loss of $31,000.

THERE should be no emotionally exaggerated concept of the T.V.A. or similar wholesaling projects. The municipalities hold the bag. T.V.A. rules and regulations force co-operating communities to give subsidized service to residential customers and require that compensating penalties be placed on other classes of service if the income be insufficient.

It is the premise of T.V.A. and other yardstick operations that enormously increased use will result from low rates. This has never occurred save where low rates have been accompanied by large expenditures for promotion and direct sales. Only the municipalities take a chance under the regulations and rates thus far specified. Red figures will bring political and financial repercussions in the municipalities when the city fathers find that they have bought a gold brick.

RECORDS

Both continuity of service and controlled maintenance require that transmission line performance and equipment records be in such form as to permit selective handling of increased insulation, protective devices and insulator requirements. There are many miles of line which date back fifteen, twenty or more years and recorded information is all-too-seldom at hand to show just where faults have occurred, breakers have operated, insulator strings have broken down and conductor burns have taken place.

Some companies have, within the past few years, found it most profitable to correlate available charts and records that insulation tests, added disks, new protective devices and anticipatory replacements may be undertaken where they will do the most good with the least outlay.

Making a buzz test of nearly a million insulators and an inspection of the conductors, clamps and shields at every tower every year is no light task and is not likely to be routine practice unless it pays. Duke Power Company does it every spring and finds it well worth while. Inspection and test data recorded cumulatively on a line-profile chart which also shows string failure and the degree of insulation needed show at a glance where maintenance and replacements, as well as new protection, are needed. It is none too soon to begin correlated record systems and inspection routines that will be least expensive in themselves and yet point the way to low cost maintenance of high-quality line performance.

BREAKERS

Criticism of the oil circuit breaker art as practiced by American manufacturers, while perhaps well merited five or six years ago, has grown to be a habit among some engineers—a fashionable habit. How much justification exists for following fashion in this matter as a criterion of judgment?

As recently as 1928 the design and building of circuit breakers appeared to be largely a matter of rule of thumb and empiricism. Then came the Deïon and associated theories of arc extinction. Since that time there has come, with amazing rapidity, the Deïon grid oil breaker, the oil-blast breaker and now the impulse breaker. Not only has size been reduced and reliability improved, but the latest design promises to solve effectively the oil hazard problem—to solve it by reducing it by 95 per cent. From a fast-action standpoint, speeds of opening have been cut from 25 to 35 cycles to 8 cycles and 3- or 4-cycle breakers are on the horizon.

Inspection procedure has been considerably simplified in that the number of operations possible before oil deterioration or contact burning has been materially increased. It is remarkable, too, that all these developments have been made with an eye to the possibility of applying the fundamentals of the new improvements to existing equipment, thus obviating the necessity of heavy obsolescence write-off.

But technical developments without actual use are of no benefit and it is full time that engineers accepted the new facilities and put them thoroughly to work. Furthermore, the ability of manufacturers to make further research and development possible, to maintain their present position, well up on the power system art of the world, depends to a great extent on the most tangible of all support—orders for equipment.

OVERHEAD

Those wood-pole distribution lines commonly occupying the streets and alleys of our cities are, as industry engineers well know, a long way from being ornamental. The question, gracefully cloaked by our British friends under the euphony of "amenities," has been fairly asked, "Is it necessary that such incongruous-looking structures be freely distributed about in these most conspicuous locations?" The long-standing answer has been that overhead lines are necessary in order to keep the average cost of power low, and that the only alternative is to remove them entirely and replace them with relatively expensive underground construction.

Detroit Edison, in a most interesting experiment, has recently tried to answer a second and third question: "Is it impossible to incorporate some elements of artistic design in these structures? It is done in other lines of work. How much thought has ever been given to these pole lines with the view to making them to some degree ornamental, rather than strictly utilitarian?"

It would be sign-of-the-times for other utilities to call in their designers and let them propose something new in the way of pole construction, rather than being resigned to removal as the only answer to criticism. It seems possible, in the light of the Detroit Edison experience, to do this without undue increase in cost if architecture and engineering are properly co-ordinated.

Our Co-operation With T.V.A.

At the request of "Electrical World" Mr. Willkie consented to make a statement in regard to the development of contractual and co-operative relations between the Tennessee Valley Authority and the Commonwealth & Southern Corporation.

His interpretation of the situation and his presentation of facts are definite and authoritative. We believe this to be a constructive and valuable contribution to the industry and that it will remove any misconceptions and any misunderstanding that may exist in regard to this important event.—EDITORS.

A statement by

WENDELL L. WILLKIE

President Commonwealth & Southern Corporation

PRIOR to the passage of the Muscle Shoals act, the Commonwealth & Southern Corporation and its Southern operating units publicly opposed the passage of that legislation. Several of my associates and I appeared before the military affairs committee of the United States House of Representatives and presented what we thought were sound reasons why the passage of such an act would result in uneconomical operations by the federal government and also in great injury to utility security holders.

The President and the Congress of the United States in their wisdom determined otherwise and the act was passed. Shortly thereafter, in accordance with its provisions, the Tennessee Valley Authority was appointed and the various members thereof made public declaration of the objects which that authority desired to accomplish under the provisions of the act.

An interview at my request was obtained with Dr. Arthur E. Morgan and David E. Lilienthal, members of the authority, and for several months thereafter we were engaged in negotiation and discussion with Mr. Lilienthal, who is the member of the authority delegated to supervise its power operations. It was gratifying to learn that Mr. Lilienthal was seeking to accomplish several aims consistent with our own views of the purpose of the electric utility industry, namely:

1. The increased use of electrical appliances, such as ranges, water heaters, refrigerators and the like, to an extent heretofore impossible of accomplishment by reason, in part, of the prices at which such appliances were of necessity sold to the public. Mr. Lilienthal suggested that the adoption of a standard design of the less expensive models of these appliances, the large-scale purchase of them and the assistance of the federal government in the financing of the sale of such appliances should assist substantially in reducing the price to the purchaser. Having long been committed to the social and business benefits of the greatly increased domestic use of electric energy, it was apparent that I could join heartily in Mr. Lilienthal's program in this regard.

2. The orderly and economical development of generating capacity, whether by steam or hydro, on a comprehensive plan by which such generating capacity would not be brought into being until uses for such energy were developed. This principle, of course, I agreed was sound.

3. That an interchange and co-ordination agreement should be entered into between the private utilities operating in the Muscle Shoals zone and the Tennessee Valley Authority in order that the full availability of the generating capacities owned by the federal government at Muscle Shoals and those owned by the private companies would be most economically operated for the benefit of the consumers of electric energy in that area.

This is a consummation which the interests I represent had long sought to bring about, but had been prevented by the delayed solution of the Muscle Shoals problem.

4. That the distribution of electric energy generally should be non-competitive in a given area and, in so far as possible in carrying out the declared policy of the federal government, the building of competitive or duplicating transmission and distribution lines should be avoided.

"Yardstick" co-operation offered

FURTHER, Mr. Lilienthal, representing the Tennessee Valley Authority, felt that provisions of the Muscle Shoals act together with the declarations of the President of the United States required the authority to establish a "yardstick." In other words, that the authority was under a mandate to construct or acquire, either competitively or by purchase, the transmission systems and have municipalities construct or acquire the distribution systems in a given area, so that it could determine the fair price at which electric energy should be sold.

In public statement and in testimony, prior to the passage of the act, I had declared, and we still believe, that such a yardstick was unnecessary for the protection of the ratepayer and that it would be very difficult to restrain those in charge of the operation of such a yardstick from making it an unfair measure.

However, the President and the Congress of the United States declared that the policy of the federal government should be otherwise. Under the circumstances we felt that policy and a due regard and respect for the judgment of those to whom the welfare of the nation had

been committed compelled us to permit the declared policy of the federal government to prevail. Consequently, after lengthy negotiation, the operating units of the Commonwealth & Southern Corporation sold certain of their transmission lines and agreed to sell to municipalities distribution systems in an area in northeast Mississippi and northwest Alabama adjacent to the Muscle Shoals Dam and in northeast Tennessee adjacent to the proposed Cove Creek Dam.

In these negotiations Mr. Lilienthal and his associates were courteous, able and ambitious to obtain this property for the Tennessee Valley Authority at the lowest possible price.

A comprehensive agreement incorporating all of the above principles was executed on January 4, 1934, and the Tennessee Valley Authority and the Southern operating units of the Commonwealth & Southern Corporation have each pledged themselves to the fullest co-operation to make its provisions effective. I am quite sure that this spirit will greatly assist in the accomplishment of sound operations by both parties.

As I see it, the possibility of failure will come with the breakdown of the sincere intent thus to co-operate and fairly perform in accord with the spirit of the agreement. If the utilities yield to the natural temptation of captious, direct or indirect criticism and the assumption and pretense of superior knowledge and skill, and approach the government operation with corresponding disparagement, the agreement will not, it seems to me, be successful.

If, on the other hand, the Tennessee Valley Authority, being wholly unregulated by commission or otherwise, yields to the temptation of not making the "yardstick" truly comparative and does not take into account the full amount of taxes paid by the utilities, the cost of money to them, the necessity of their regularly meeting fixed obligations or unfairly allocates its own costs, then likewise the plan will fail.

To a fully co-operative spirit, in thought as well as act, we have pledged ourselves and intend to carry through and I am confident that with the character of the members of the Tennessee Valley Authority that they will do likewise.

It is my belief and conscientious desire that out of the operation under this agreement may be born a common understanding that will not only admit of but recognize and protect the vast interests of private property invested in the public utility industry.

Transfer Feeder Faults to One Breaker

By L. F. WOODRUFF and J. E. MULLIGAN
Department of Electrical Engineering, Massachusetts Institute of Technology

With a newly developed fault transfer switch it is thoroughly practicable to have a single breaker act for individual protection of a number of feeders.

Just another and important step in simplification of industry practice and in making useful equipment work harder.

CONSIDERABLE interest has been manifested recently in the technical literature in connection with the problem of feeder protection. Numerous circuits are in use in power stations and substations for enabling circuit breakers to open short circuits in feeders. Perhaps it has seemed axiomatic that there must be provided at least one breaker per feeder if fault interruption is to be accomplished without affecting service on other feeders.

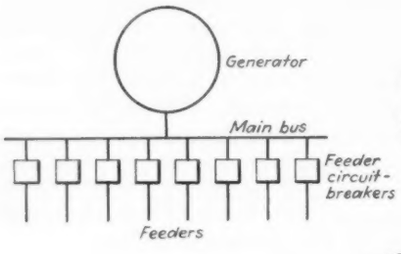


Fig. 1—Each feeder protected by a full-capacity breaker.

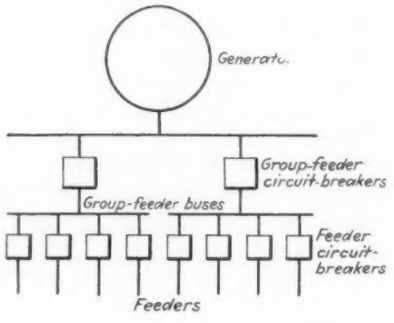


Fig. 2—One full-capacity breaker protecting a group of feeders, with low-capacity breakers in each feeder.

Simple schematic diagrams of the circuits at present in use for individual and group feeder protection, respectively, are shown in Figs. 1 and 2. There are many different detail circuits in use, all of which may, however, be classed as variations under one or the other of the two circuits shown. If the general plan of Fig. 1 is used the number and expense of the breakers are large, and this fact has led to the use of breakers of inadequate size as an attempted economy measure. To provide for circuit-breaker failure a second back-up breaker is often connected in each feeder, with a further increase in expense. If the general plan of Fig. 2 is used, with the group-feeder breakers alone capable of interrupting the full short-circuit current, the occurrence of a fault on one feeder always requires the opening of all feeders in the same group in order to clear the fault. Very few large power companies are willing to put such an obstacle in the path of service continuity.

The situation in the majority of the important stations, using the circuit of Fig. 1 or some variation of it, is akin to having a stable full of idle horses—a heavy expense in the form of fixed charges and maintenance—and our animals work only about two seconds each during the course of a year. The solution is simple. Get

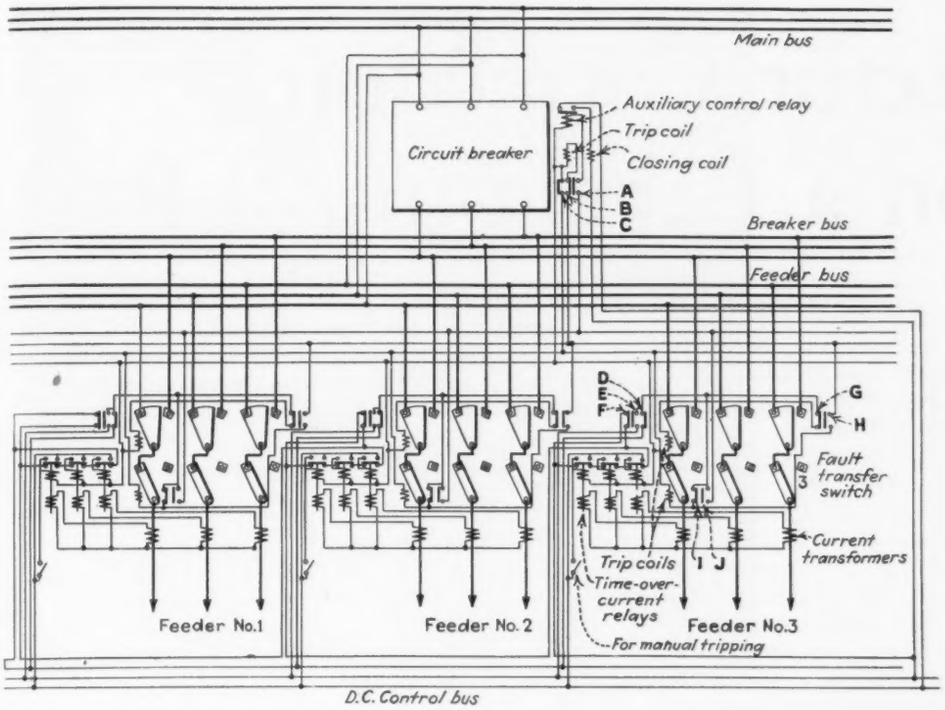


Fig. 3—Several feeders protected by a single-circuit breaker

All feeders normally receive power from the feeder bus. When a fault occurs on any feeder the upper blade of the fault transfer switch first connects the feeder to the breaker bus and then disconnects it from the feeder bus. Next, the circuit breaker opens the short circuit, then the lower blade of the fault transfer switch disconnects the faulted feeder. Lastly, the circuit breaker recloses automatically.

In reclosing the fault transfer switch, first the upper and then the lower blade should be returned to its normal position.

A to *J* indicate auxiliary switches. All switches are shown in their normal positions. When a fault occurs their operations are: E closes, then *F* and *D* open, when upper blade of fault transfer switch leaves position 1. *H* closes, then *G* opens, when position 2 is reached. *A* and *C* close, then *B* opens, when the circuit breaker is open. *J* closes, then *I* opens, when lower blade of fault transfer switch reaches position 3.

rid of most of the horses and let the remainder do more work. Get rid of the nags and have one or two thoroughbreds.

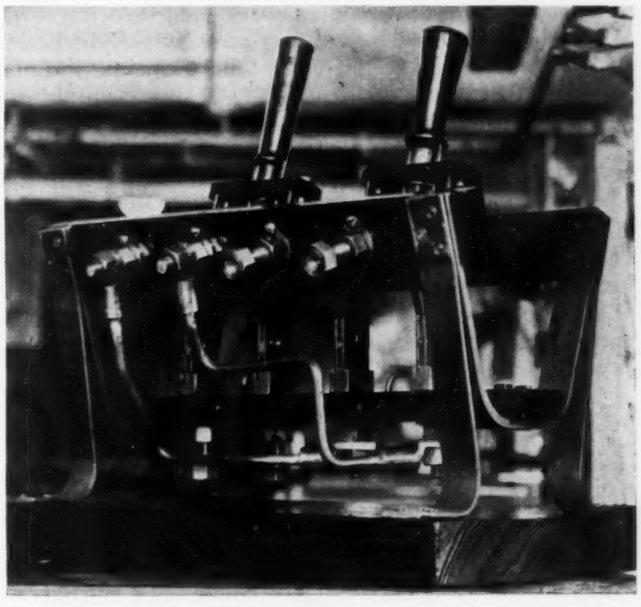
Refer to the circuit of Fig. 3. The characteristics of this plan are similar to those of Fig. 1 in that individual feeders may be opened without affecting the others, but it is similar to the circuit of Fig. 2 in that only one circuit breaker capable of interrupting the total short-circuit current is required. It does not require a circuit breaker in each feeder for interrupting the short-circuit current which may flow to a faulted feeder from the other feeders. The single circuit breaker not only disconnects the faulted feeder from the main bus but from the other feeders as well.

When a short circuit occurs on a feeder a relay trips an inexpensive make-before-break air switch, which may be designated as a fault transfer switch, and this switches the faulted feeder from the group-feeder bus to a special breaker bus. There is no arcing at the switch points, since the current is not interrupted, but is merely transferred from one contact to another at the same potential, except for a few volts drop in the loop between the two buses. The transfer complete, the short-circuit current is now immediately opened by the circuit breaker. As soon as the current has been interrupted the air switch acts again, opening the feeder, and following this the circuit breaker recloses automatically, ready for service again.

The cost of the transfer switch can be kept to a small fraction of the cost of a breaker of the same rating and its maintenance expense should be correspondingly less. The transfer switch can also be made to perform the function of the disconnect switch, and by the addition of one more contact per phase of a test switch for testing a faulted feeder on low voltage before reclosing it on normal voltage.

The type of transfer switch made up for test and use at the Massachusetts Institute of Technology is shown in Fig. 4. It has a load rating of 100 amp., but is capable of switching 2,000 amp. from one set of points to the other without arcing. The blades are snapped across by a heavy spring when the trip coil is operated by a protective relay, which may be of any ordinary type.

Fig. 4—Fault transfer switch



With this plan a single back-up breaker will serve for all feeders of the group. It may be connected in series with the circuit breaker of Fig. 3, to provide for opening the circuit in case that breaker fails, or in the leads from the main bus to back up both the breaker and the transfer switches.

Engineers familiar with present breaker practice will readily recognize the possibility of various modifications of the circuit shown, whereby the new principle of selecting a breaker when it is needed, rather than having it stand idle in a circuit until a fault occurs in that particular circuit, may be extended to take care of special conditions or requirements peculiar to individual stations or systems.

Power-Factor Correction on a Benefit-to-All Basis

Industrial energy users, the utility and electrical manufacturers all gain definite benefits under the power-factor correction plan recently developed by the Blackstone Valley Gas & Electric Company.

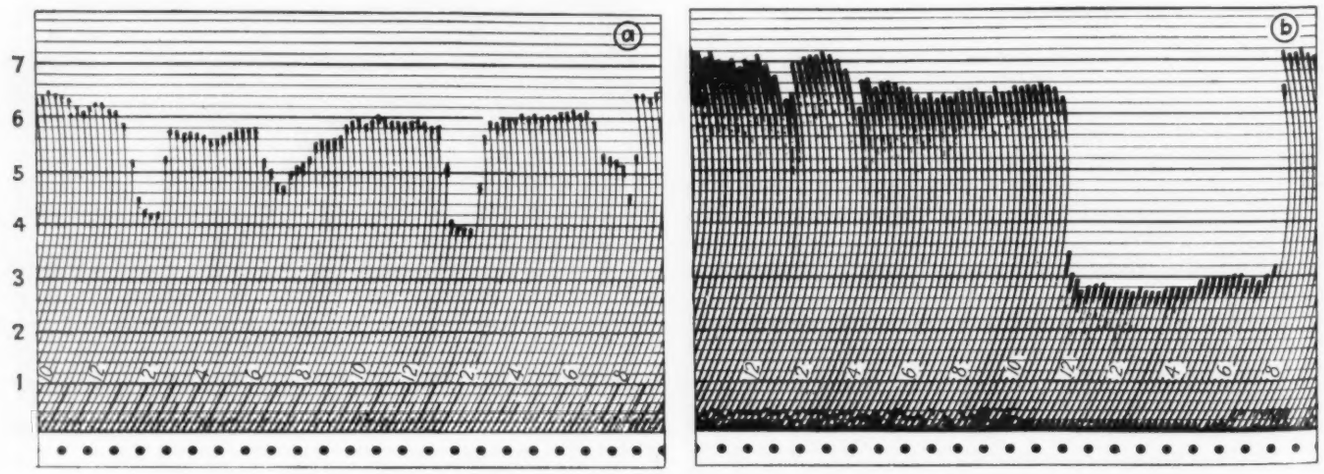
More than 4,000 kva. in capacitors installed on strictly economic basis.

INDUSTRIAL customers of the Blackstone Valley Gas & Electric Company, local contractors, the utility itself and electrical manufacturers are common beneficiaries of a program of localized power-factor correction which has been gaining headway during the past year under the auspices of the company's industrial service department. According to L. H. Knapp, chief industrial service engineer, in charge of the development, "the plan aids all interested parties. To the customer it means lower bills if he raises his power factor and better voltage regulation; the contractor obtains a resale profit on capacitors and a legitimate wiring profit; the manufacturer co-operates to sell good equipment at standard prices, and the utility achieves a saving in plant and system capacity at a satisfactory cost per kva. figured in terms of bonuses paid for improved power factor and such financing costs as may be necessary. On January 1, 1934, the total capacitor installations on the system aggregated 4,091 kva.; the annual power-factor charges avoided by their installation totaled $15,005; the bonuses paid for high power factor totaled $21,735 per year and the net charges for low power factor billed customers were $18,030. The cost of the installations totaled $43,450 and the equipment released 3,104 kva. in transformer capacity for future reallocation to other parts of the system. Such has been the effect of power factor billing in the cases of 126 of the company's largest industrial customers, and the work is progressing steadily toward still better conditions."

The Blackstone Valley company, a Stone & Webster property centering in Pawtucket and Woonsocket, sells nearly 80 per cent of its entire output to industries at present. Its total energy sales are about 174,000,000 kw.-hr. per year. The industries served embrace cotton, silk, woolen and rayon textile mills, metal-working plants, wire and miscellaneous manufacturers. The industrial service department maintains constant personal contact with conditions in these mills; advises customers in regard to rates, power applications, motor and control selection, power-factor correction and illumination, but does not sell motors. Qualified local contractors familiar with industrial problems are able to maintain staffs competent to handle many mill problems as a result of the co-operative policies of the utility.

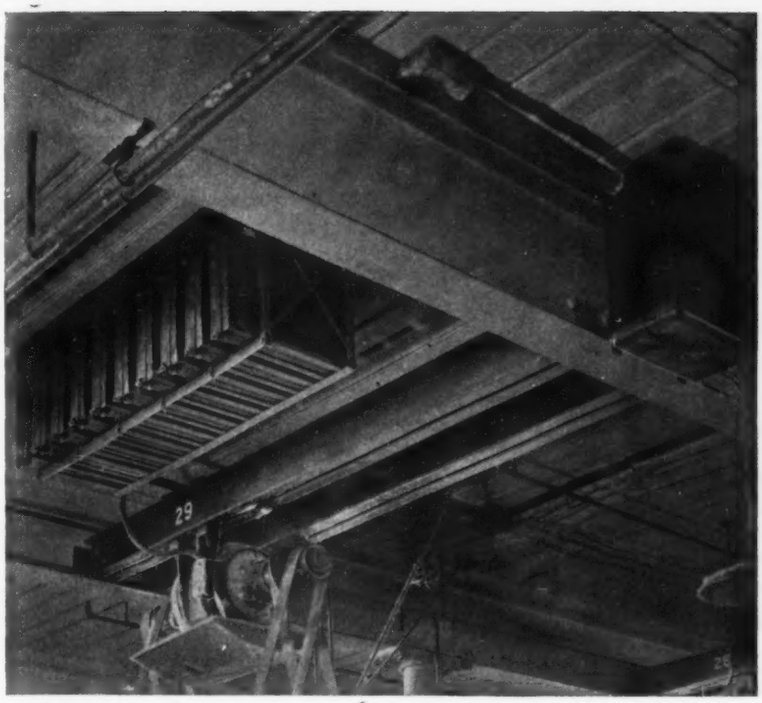
Power-factor charges recently put into effect

In the summer of 1931 the company established a rate under which it pays a bonus or credit for power factors established above 80 per cent on installations



Shorter hours increase industrial peak

In a typical industrial plant on the Blackstone Valley system the shortening of the working day by the code under NRA jurisdiction increased the power demand between 8 a.m. and midnight by a maximum of about 7 per cent, but it reduced the total energy consumption from midnight to morning by a heavy slump in usage, as shown in sections (a) before the code was applied and (b) after the code went into effect. The plant load factor was therefore reduced to the disadvantage of the utility and of the customer. The importance of maintaining a high power factor under such conditions is evident, as curtailment of manufacturing hours puts a premium on more intensive use of plant during the hours when the code permits manufacturing operations.



Textile plant puts capacitor on ceiling

Lint on the motor and lamp reflector show the need for using dustproof capacitor.

Remote control for capacitors mounted at any convenient point

In this case they are mounted on a column, the magnetic switch usually being close to the capacitor bank as shown in the illustration at the left.

of more than 50 kw. demand. This credit is obtained by deducting from the demand charge for each month a percentage represented by the ratio of the 80 per cent base to the measured power factor. That is, a measured power factor of 90 per cent yields a credit of 1/9 of the basic demand charge, the billing charge being 8/9 of the latter. Adjustment does not apply to installations under 50 kw. demand. The maximum credit allowed by the company is 15 per cent of the demand charge applying after power-factor correction; i.e., the demand charge after adjustment for power factor cannot be less than 85 per cent of the demand charge before adjustment.

At the opening of 1934 the company began to charge a penalty for power factors under 80 per cent lagging, with the limitation that the penalty should not exceed 30 per cent of the demand charge before correction. The penalty or power-factor charge, as the company prefers to call it, is determined by computing the ratio of the base power factor of 80 per cent to the measured power factor and multiplying this into the demand charge. Thus, a 70 per cent measured power factor would call for the multiplication of the demand charge by 8/7 to ascertain the exact billing charge.

Method of measuring power factor

The company announced its intention to make a charge for low power factor in a circular mailed to the industrial customers of 50-kw. rating and over, which stated:

"Power factor" is the name given to the relation between the useful current and the total current that is taken by your power motors. Poor power factor wastes productive capacity of electrical equipment of both electric company and consumer. In order to encourage the saving of this capacity, the power rate provides a charge or a credit depending upon whether the power factor is poor or good.

If your power factor is poor you can change the charge into a credit if you provide the corrective equipment. Beginning January, 1934, all charges and credits will be made in accordance with the power rate under which you are supplied subject to clause regarding power factor. Our engineers are available to you without charge to advise about power-factor correction.

The company measures the average power factor by using watt-hour and reactive-kva-hour meters, either as combined or separate units. By dividing the record of the reactive-kva. meter by that of the watt-hour meter expressed in kilowatt-hours, the accounting department obtains a figure representing the tangent of the angle of lag in the local installation. The division is done mechanically and the resulting quotient is compared with a table giving the values of tangents on each side of the corresponding unit power-factor values expressed as cosines of the angles of lag. In this way the accounting clerk is not obliged to figure the exact power factor

Table I—Power Factor Billing Values

(30 per cent added below 60 per cent power factor)

Tangent Range and Power Factor	Adjustment in per Cent of Service Charge Per Cent Added	Tangent Range and Power Factor	Adjustment in per Cent of Service Charge Per Cent Added
1.350799		0.815434	
60 per cent	30	78	2.6
1.316075		0.789167	
61	30	79	1.3
1.282158		0.763031	
62	29	80	
1.249000		0.736987	Bonus Starts
63	27	81	1.2 off
1.216555		0.710995	
64	25	82	2.4 off
1.184779		0.685009	
65	23.1	83	3.6 off
1.153632		0.658982	
66	21.2	84	4.8 off
1.123073		0.632860	
67	19.4	85	5.9 off
1.093063		0.606582	
68	17.6	86	7.0 off
1.063567		0.580083	
69	15.9	87	8.0 off
1.034546		0.553283	
70	14.3	88	9.1 off
1.005968		0.526092	
71	12.7	89	10.1 off
0.977796		0.498398	
72	11.1	90	11.1 off
0.949998		0.470068	
73	9.6	91	12.1 off
0.922540		0.440933	
74	8.1	92	13.0 off
0.895389		0.410775	
75	6.7	93	14.0 off
0.868510		0.379302	
76	5.3	94	14.9 off
0.841870		0.346106	
77	3.9	95	15.0 off

15 per cent off for power factors above 95 per cent.

Table II—Benefits Realized by Typical Industrial Plants from Power-Factor Correction

(in Diversified Manufacturing)

Plant	Normal Demand Kw.	Avg. Power Factor Before	Avg. Power Factor After	Monthly Demand Charge Dollars (.80 P.F.)	Dollars Annual Savings Resulting from Capacitor Installation: Charges Avoided	Credits Earned	Total	Capacitors Installed Kva.	Installed Cost Dollars	Reduction in Kva. Demand
1	6,500	0.75	0.80	6,500	5,226	....	5,226	900	11,000	542
2	1,700	0.79	0.90	1,565	244	2,085	2,329	500	6,300	263
3	480	0.74	0.90	505	491	673	1,164	200	2,500	115
4	385	0.80	0.90	429	....	571	571	100	1,500	53
5	165	0.52	0.80	212	763	....	763	150	2,050	111
6	125	0.70	0.92	172	295	268	563	75	925	43
7	100	0.59	0.94	147	529	263	792	100	1,375	63
8	70	0.64	0.90	117	351	156	507	50	650	32
9	95	0.66	0.85	142	361	100	461	50	675	32
10	55	0.75	0.93	95	76	160	236	26	375	14

of the installation for decimal values between integral values. In other words, it is assumed for billing purposes that a particular power-factor value, such as 90 per cent, applies to angles with tangents between 0.498398 and 0.470068. To illustrate, assume that the quotient of the reactive-kva. meter reading divided by the kw.-hr. meter reading is 0.485150. This is the tangent of an angle whose cosine is between 0.895 and 0.905. To save work it is assumed that this is the angle whose cosine is 0.90. The corresponding adjustment in the service charge is a bonus of 11.1 per cent, applied as a cut of 1/9 in the demand charge of the installation. Table I gives the adjustment values between 60 and 100 per cent power factors as used in billing.

An investigation by the company shows that the use of average power-factor figures is sufficiently accurate for billing purposes, the difference between these and power factors taken at the time of the peak being insufficient materially to disturb the results.

Merchandising and financing capacitors

Coincident with the company's decision to apply both power-factor bonuses and charges to power customers after January 1, on the "E" rate over 50 kw. demand, the company announced that so far as practical it would delegate the merchandising of capacitors to the local contractors and manufacturers' representatives. While it was realized that the industrial service department engineers would still continue to do a large part of the engineering and sales work in connection with the power-factor correction, it is hoped that the company can co-operate with the contractors in such a way that they will eventually handle capacitor sales in much the same manner as they handle motor sales. Until July 1, 1934, the company plans to continue to finance capacitor purchases and installations where necessary.

Efforts to sell capacitors or other power-factor corrective apparatus may be made by promotional advertising and sales activity, and in a limited way, by members of the industrial service department. The utility co-operates in mailing sales material to prospective customers, on approved apparatus, and its industrial sales engineers will co-operate to any reasonable extent in the engineering necessary to purchase and install corrective equipment. It is assumed that capacitors will be sold at the manufacturers' established retail prices plus freight from the factory. If the purchaser wishes to divide the payment, the utility will do the financing if the credit is approved. Normally payments are to be completed in one year, the carrying charge being 6 per cent of the initial cash price. If necessary to extend the term the carrying charges become 7½ per cent for eighteen months and 9 per cent for two years based on the original amount.

If the contractor supplies the capacitors he can assign the account to the utility, which pays him the full cash price and collects the term price from the purchaser. If the contractor secures the capacitors from the utility company's stock, the power company gives him an order for installing the equipment and instructs him to bill it for the installation plus the resale discount. Under either of these plans it is expected that the contractor will make a commission or profit of about 10 per cent of the regular retail price, plus his installation profit. In return, the contractor is expected to do what he can to develop this business, and assumes responsibility for the correct and safe installation of the equipment.

Results in typical industrial plants

The benefits to specific customers from capacitor installations are illustrated in Table II, which gives the basic data for a few typical cases where power factor has been raised in this way. Each installation was separately analyzed by the industrial sales department and the capacitor units selected for the local specific requirements. The corrective apparatus manufacturers include the General Electric, Westinghouse, Electric Machinery, Dubilier and Wagner companies. It is noteworthy that 126 leading industrial customers have summated demands of 42,379 kw. and pay approximately $510,560 annually in demand charges. The reductions in demand charges obtained through power-factor correction justify the installations from the standpoints of both customers and company.

Time to Sell Power, Right Now

Many of our present customers have been waiting for the first signs of better business to release orders for additional or replacement manufacturing equipment or commercial facilities that they need and can use. Electrification goes hand in hand with this expansion or renovation. In our territory a cement mill has just ordered between $30,000 and $50,000 worth of new crushing apparatus which will use some 300 hp. in motors. An Omaha department store, for years held back by lack of modernization, is now stepping out with a renovation program, including greatly increased show window lighting and a complete new illumination layout, which will probably double the former connected load and use. There are many factories and business establishments that have been watching conditions and waiting for signs to point the opportune time to go ahead. They are now just ready for long-postponed replacement, improvement and even moderate expansion, in which, if we are on the job, electrification can play an important part.

FORD BATES,
Nebraska Power Company.

Mr. Bates so addressed power salesmen at the recent engineering conference of the Missouri Valley Electric Association.

Carrier Control Isolates Trouble on Tap Lines

Not a special design of control apparatus, but standard carrier-current units have been used for this simple yet effective solution of a familiar remote-line problem

Utilization of standard carrier-current equipment for controlling tap lines remote from substations by the use of carrier current has recently been worked out by the General Electric Company. E. B. Weedon of the Boston office switchgear division of the engineering department states that the scheme is particularly useful in isolating trouble on taps of main lines difficult of access,

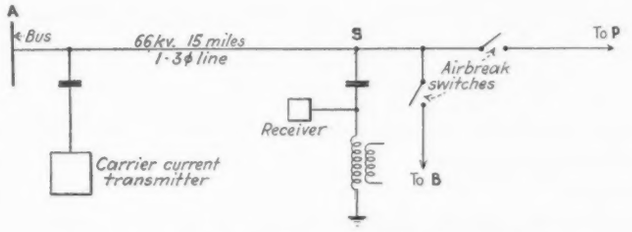


Fig. 1—Carrier units and airbreak switches at main substation

in maintaining service on branch circuits free from trouble beyond a sectionalizing point and in speeding service restoration in areas requiring considerable time to patrol. In a typical case analyzed, where the sectionalizing station was located some 15 miles from the substation and in extremely rough country, it was found that the carrier scheme would be less costly to install than supervisory apparatus by approximately the expense of the necessary supervisory cable.

The specific layout studied, Fig. 1, embraced a large distributing substation, "A," from which a single-circuit 66-kv. line ran into the hill country to a non-attended sectionalizing station, "S," where tap lines branched to towns "P" and "B." The outgoing line was equipped with an automatic oil circuit breaker at "A" and with hand-operated airbreak sectionalizing switches at "S." In some cases it takes a trouble man from one to six hours to reach the sectionalizing station in bad weather. The solution of the problem of quickly isolating the faulty section was found to be to use carrier current in conjunction with motor-operated airbreak switching, with a 48-volt storage battery for the motor service and a trickle charger for the cells.

At the substation "A" a carrier-current transmitter (Fig. 2) is shown with capacitor coupling to the outgoing line, a standard governor control hand-operated switch being specified to send either a positive or a negative half-wave carrier impulse over the line. The recommended transmitter is the General Electric Company's GCS 9-A signal unit, with a carrier range of from 50 to 100 kilocycles. At sectionalizing station "S" the receiving element advisable is the SCS 6 A double receiver. This is shown connected to the 66-kv. line by a coupling capacitor, ground return being used for one side of the carrier circuit. The receiver, *R*, has two thermal relay contacts, *a* and *b*, designed to complete the set-up for contacts opening and closing the motor-driven airbreak switches 1 and 2 on the tap lines to "P" and "B" by the use of storage battery energy. The receiver and an undervoltage relay, *U*, are energized by 115-volt, 60-cycle energy obtained from the transmission line through a potential device, K A 111. The motor mechanisms for driving the airbreak switches are indicated at *a'* and *b'*, *C* and *O* being the closing and opening motor coils.

Patrol work guided by indications

The sequence followed in case of a fault on tap line "B" illustrates the scheme:

Assuming that the fault opens the oil circuit breaker at substation "A" the undervoltage relay *U* closes at sectionalizing station "S." Battery current flows through the contacts in the receiver and the motors open the airbreak switches on both taps after a short time delay. The operator now closes the breaker at "A" and finds the line normal between "A" and "S." The relay *U* opens. The operator does not know on which tap line trouble exists, or whether it has been cleared. He decides to try to put line "P" back and sends a carrier wave over the line to "S," actuating thermal relay *a* and setting up contacts in the receiver in preparation for closing the airbreak switch on tap "P." He next opens the oil circuit breaker at "A" for about ten seconds, allowing the relay *U* to close and complete the battery circuit through the airbreak switch motor *a* before the thermal relay upper contact opens (about 30 seconds is required for this last). The airbreak switch to "P" has now been closed. The operator at "A" closes his oil breaker and finds that the "P" tap line is normal.

With the closing of the oil breaker at "A" relay *U* opens. The operator sends out the other half cycle carrier wave and the thermal relay contact *b* is made at the upper point. The procedure follows the previous routine. When the circuit breaker at "A" is closed to determine whether trouble exists on tap line

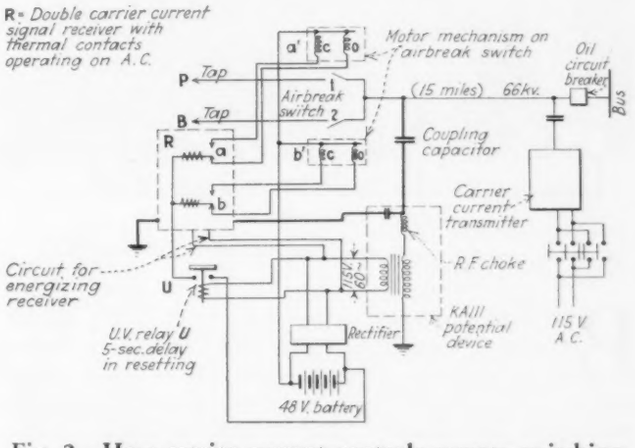


Fig. 2—How carrier current controls remote switching

The heavy line shows the path of the carrier waves at sectionalizing station "S." Station "A" bus is shown at the extreme right.

"B," if the fault has been burned off or otherwise eliminated, service is resumed on a normal basis on both branches. If the fault persists on tap line "B" the procedure is begun over again (as the airbreak switches open after the oil breaker) and tap line "P" put back into service, line "B" being open until the trouble is cleared by the outside force.

The scheme provides a means of determining which section of line is affected without leaving the substation and which direction patrol work must follow to relieve the situation most rapidly.

87-Kw. "Home of Tomorrow" Points to Higher Energy Use

Kitchen has its range and dishwasher built in

Many other smaller convenience appliances also in-built. A serving pantry affords its own refrigerator, food mixers, etc., for occasions when the full facilities of the kitchen are not required.

To anticipate the 1950 home today calls for 87 kw. of connected electrical aids. It means a usual month's energy use every day.

That it requires 25 kva. of transformer capacity, some 100-amp. circuit breakers, eight load centers and more than three miles of wiring is index enough of what it presages as an impending market for kilowatt-hours, for distribution facilities, for wiring and wiring devices, for in-built appliance comfort and for the long longed-for lighting.

BOOSTING the average residential electrical customer from 600 to 1,200 or more kilowatt-hours per year is the immediate problem of the electrical industry. Every bit of refrigeration, cooking, water heating and air conditioning sold advances the average slowly but steadily. A few big jumps would be worth many small ones. If only one in 30 of America's homes could have its usage multiplied by 30 the average for all homes would be doubled. Westinghouse at Mansfield, Ohio, has built just such a "home of tomorrow" which presages a usage of 1,500 kw.-hr. per month, as against today's 50. Naturally wiring, overload protection and internal controls to match such demands and consumptions must be conceived on a radically different scale from that which applies to today's conventional job of wiring. Nineteen built-in motors (including those for the air-conditioning system and the garage doors, etc.), panel heating in the penthouse sunroom, laundry and towel driers, reversed refrigeration water heating, profuse lighting and a multiplicity of built-in small appliances are the components which bring the connected load to a total of 87 kw. and the expected demand to 25 kw.

The house is an eight-room, two-story, brick-veneer insulated one with approximately 24,200 cu.ft. of volume. It is of such character as to be constructed for $11,000, including the prevailing average of wiring and electrical facilities. As actually equipped, assuming prices based on commercial production of the pieces now only experimentally hand-built for this test home, it is estimated that the cost today would not exceed $12,500. Air conditioning represents $700 to $1,000, as against the usual hot-air heating system costing about $350. Ordinarily $200 would cover the wiring for a home of this size, but the outlay here to meet the greatly increased requirements is approximately $1,000. The rest of the difference between the home of today and the home of tomorrow is due to in-built electrical appliances after credit has been made for appliances that are now common in homes, but not customarily called part of the house.

Westinghouse states that this is not so much a model home as it is an experimental home in which to perfect the design, performance and comfort contributions of electrical facilities. Finish and refinement testify, however, to its complete livability and practicality. The fact that the wiring is to a large extent knob-tube-loom does not, however, clash with permanence and modernity, even though it facilitates some of the experimental load studies that will be undertaken in perfecting the appliances commercially and in disclosing their load-building potentialities.

Service reliability the goal

A home with a load of this magnitude demands dependability of service. To eliminate the service interruptions which originate at and within conventionally installed transformers, this one is served by a 25-kva.

surge-proof transformer. The customary primary fusing is replaced by a secondary breaker in the transformer oil with a supplementary fuse also immersed in the oil. Service to the house is an underground three-conductor No. 4/0 lead-covered cable with neutral grounded at the service entrance. In view of the load magnitude a three-wire current transformer is installed at the service entrance and the four No. 12 secondary leads for current and potential run to the 5-amp. two-wire outdoor meter.

Loads in the home are broken into four main groups, each served through a circuit breaker of appropriate rating. One carries the air-conditioning, water-heater, laundry, range and basement and kitchen circuits. Another is exclusively for the sunroom panel heating. A third serves the first floor, second floor, sunroom lights and convenience outlets and the lighting and door mechanism of the attached garage. The fourth is further subdivided into two groups serving the night lights, burglar lights and the rectifiers for the intercommunicating telephone and indicating instruments for air conditioning, etc. In all there are eight "no-fuze" load centers, which make the house completely fuseless.

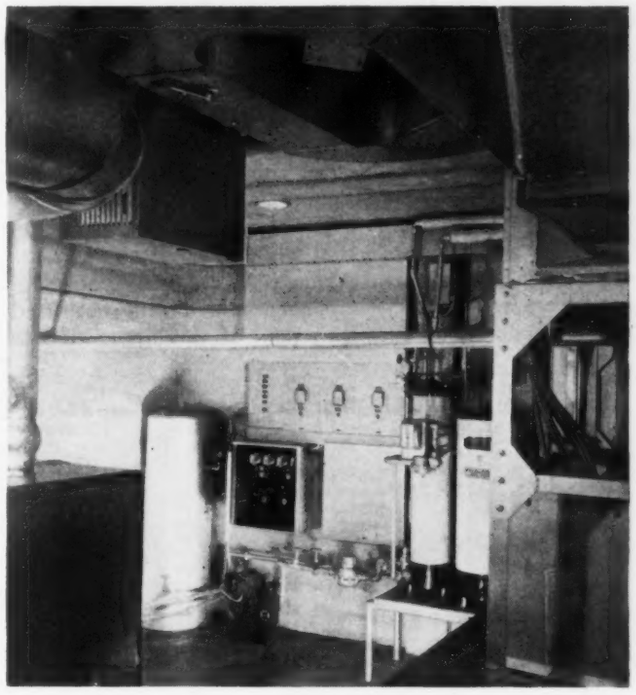
Normal wiring greatly exceeded

To contrast the electrical wiring job with today's average home it may be mentioned that the first main group of loads is fed by a three-wire No. 1 circuit. The penthouse sunroom of the roof has a No. 4 circuit for its 36 75-watt panels and so does the third group which constitutes the lighting loads. Circuits that are ordinarily No. 14 here become mostly No. 6 to No. 12 because of the large increase in currents handled even for lighting circuits. Some conception of the extent to which the installation transcends the ordinary one is obtainable from the following wiring figures.

Altogether about 3¼ miles of the best grade rubber-covered, flame-retarding copper wire, exclusive of an additional 1,260 ft. of "Nichrome" wire contained in the 36 panel heaters in the sunroom ceiling and walls, has been used in this home. Itemizing, the seven radio outlets use 1,500 ft. of No. 14 wire, the intercommunicating "Vocalphone" system uses 1,300 ft. and the "Electrotemp" room temperature recorder an additional 400 ft. Seventeen telephone outlets use 1,000 ft. of No. 18 wire and the doorbell circuit accounts for another 250 ft. of the same size wire.

That is what it takes to reach 87 kw. of connected load distributed as shown in Table I. Lighting alone takes nearly 20 kw.; power for appliance motors, fans, air conditioning, garage doors, etc., represents more than 10 kw.; the heating, including about 11 kw. for the sunroom panels and 16 kw. for cooking, amounts to more than 42 kw.; convenience outlets account for the remaining 15 kw.

Hot water supply for the house utilizes a combination of standard immersion electric heaters and a motor-driven compressor through which water from the storage tank is circulated to pick up heat from the process of changing the refrigerant from a gas to a liquid. Most



"Weather room" also houses water tank and water softener

Two floor levels were necessary to give sufficient drop between air-conditioning equipment and steam boiler (extreme left) to bring steam condensate back to boiler by gravity. High elevation of house necessitated pressure pump and tank for water supply. Directly over the steam boiler is "pick-up" unit which transfers its heat through a refrigerating unit to the hot water storage supply of the house.

Laundry a model of convenience and compactness.

Electrically heated sterilizer at the right. Next is cloverleaf washer with three washing units (cleanser, rinser and bluer simultaneously if so desired) clustered about central spin-drier. Ironer at left is built flush into bench for convenient operation from chair.

of the heat is extracted from the atmosphere of the "weather" room, the compressor being made to act as a heat pump to transfer heat from the atmosphere to the water. Automatic control holds the water temperature between 140 and 150 deg. F. Water heating is expected to consume 500 kw.-hr. per month.

In the kitchen all equipment used in the preparation of food has been organized and located to save steps. The electric range, especially designed and constructed for this house, has its four top units placed in a row at the front of the range to eliminate the necessity of reaching over one unit or utensil to get to units in the rear. Two of the heating elements are of 2,500-watt capacity and operate at 15 volts, permitting the placing of cooking utensils directly on the heating element. A third unit has a special control permitting regulation from 2,500 watts down to 500 watts in a large number of small steps. The fourth unit is a standard 1,200-watt "Corox Quick Cook" type. The 18-in. oven is larger than standard and is equipped with a light automatically operated by the door hinges. The broiler, with heating unit on top and bottom, slides in and out like the drawer of a table. Food mixers and similar equipment are permanently installed. Range consumption is estimated at 135 kw.-hr. per month.

The dishwasher functions automatically once it is loaded. The electric refrigerator is automatically defrosted by the same clock that tells kitchen time. Off the kitchen is a serving pantry which has its own electric refrigerator, food mixer, cupboard and sink to be used for occasions where the equipment of the larger kitchen is not needed. For refrigeration the monthly consumption is placed at 100 kw.-hr.

Everything aimed at comfort

All laundry equipment is electrically operated, laid out to pass the clothes from one operation to another in one direction on the same level. Adjoining an electrically heated sterilizer is the built-in cloverleaf washing machine of monel metal and porcelain enamel, consisting of three large tubs, each with a motor-driven agitator and with a large spinner-type wringer in the center of the group. Washing, rinsing, bluing and wringing can be carried on simultaneously. Each tub is connected with a drain and supplied with hot and cold soft water. Two clothes-drying ovens are electrically heated and ventilated and automatically cut off the heat when the clothes are dry.

An electric ironing machine unfolds out of the work table surface into a position which permits its operation from a sitting posture. For hand ironing a large ironing board swings out from under a work table on the opposite side of the room, and a permanently connected electric iron with automatic temperature control which is turned off or on by the opening or closing of its cabinet door is within easy reach. These and other miscellaneous uses are expected to take 195 kw.-hr. per month.

As compared with the average eight-room home with its 28 incandescent lamps, this home has 320. Most of the fixtures are set flush in the walls or ceiling or, as in the dining room, recessed into the ceiling. Cupboards and refrigerators are lighted when their doors are opened, as are also the ordinarily unlighted closets. Wherever illumination can serve a useful or decorative purpose it has been installed. Monthly consumption for lighting is set at an average of 90 kw.-hr. Foot-candle intensities are high, as will be seen from Table IV. The kitchen is given 45 foot-candles and bathrooms up to 55.

Table I—Mansfield House Is an 87-kw. Load

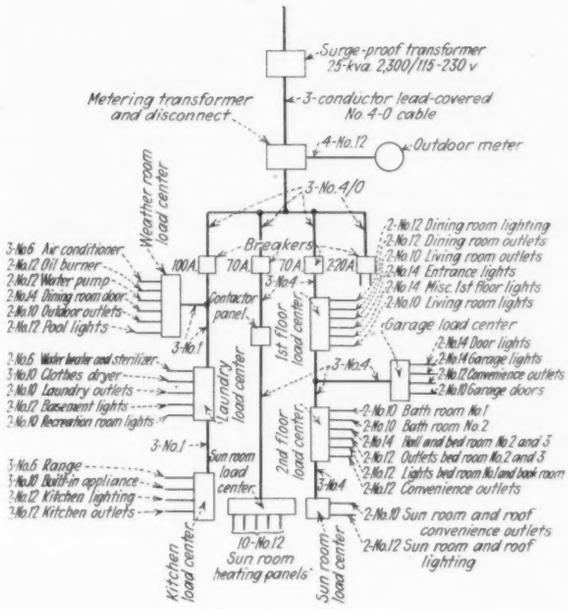
Area	Lighting	Power		Heating		Convenience Outlets	Total
Basement	2,920	Air-conditioning motors	3,850	Clothes drier	4,000	1,900	
		Air-conditioning control	650	Ster. and hot plate	4,000		
		Oil burner	500	Water heater	3,000		
		Washing machine motor	400	Ironer	1,000		
		Water pump	200	Reversed refrigeration	600		
		Ironer motor	200				
		Auto. door (1st floor)	200				
		Control	100				
		Drier fan	60				
	2,920		6,160		12,600	1,900	23,580
Kitchen, breakfast room, serving pantry	1,560	Built-in appliances	4,000	Range	14,000	1,200	
		Fan (kitchen)	60	Oven	1,200		
		Fan (breakfast room)	60	Serving table	1,200		
	1,560		4,120		16,400	1,200	23,280
Dining room	1,800					2,200	
Living room	3,000					1,500	
Misc. lighting	1,750					300	
	6,550					4,000	10,550
Garage	1,550	Door motor	600			600	2,750
Bathroom No. 1	775			Solar glow heater	1,320	150	
Bathroom No. 2	650			Air duct drier	1,320	150	
				Heater (shower)	300		
	1,425				2,940	300	4,665
2nd floor hall	200					150	
Bedroom No. 1	700					750	
Bedroom No. 2	500					450	
Bedroom No. 3	100					600	
Bookroom	1,100					500	
	2,600					2,450	5,050
Terrace roof porch	320					300	
Closets and misc.	500						
Sunroom (penthouse)	300			Panel heating	10,800	1,800	
Roof porch	320						
Night and burglar lights	600						
Outdoor pool	600					2,400	
	2,649				10,800	4,500	17,940
Grand Totals	19,245		10,880		42,740	14,950	87,815

Table II—Approximate Division of Monthly Load

Appliance	Kw.-Hr. per Month
Water heater	500
"Weather" room	250
Penthouse heating	230
Range	135
Refrigerators (3)	100
Lighting	90
Miscellaneous	195
Total monthly consumption	1,500

Table III—Large Quantity of Wiring Devices Required for Home of Tomorrow

Double convenience outlets	71
Single convenience outlets	16
Radio outlets (aerial, ground and single convenience)	9
Electric clocks	7
Lighting outlets	113
Night and burglar lights	24
Pilot lights	4
Telephone outlets	8
Load centers	8
3-way switches	26
1-way switches	65
Wall box breakers	5
Door switches	5
Key switches	2
Push-botton control switches	6


Surge-proof transformer 25-kva. 2,300/115-230 v
Metering transformer and disconnect
3-conductor lead-covered No. 4-0 cable
4-No. 12
Outdoor meter
3-No. 4/0
Weather room load center
Breakers
100A
70A
70A
220A
3-No. 4
Contactor panel
3-No. 1
1st floor load center
Laundry load center
2nd floor load center
Sun room load center
Kitchen load center
10-No. 12 Sun room heating panels
3-No. 6 Air conditioner
2-No. 12 Oil burner
2-No. 12 Water pump
2-No. 14 Dining room door
2-No. 10 Outdoor outlets
2-No. 12 Pool lights
2-No. 6 Water heater and sterilizer
3-No. 10 Clothes dryer
2-No. 10 Laundry outlets
2-No. 12 Basement lights
2-No. 10 Recreation room lights
3-No. 6 Range
3-No. 10 Built-in appliance
2-No. 12 Kitchen lighting
2-No. 12 Kitchen outlets
2-No. 12 Dining room lighting
2-No. 12 Dining room outlets
2-No. 10 Living room outlets
2-No. 14 Entrance lights
2-No. 14 Misc. 1st floor lights
2-No. 10 Living room lights
Garage load center
2-No. 14 Door lights
2-No. 14 Garage lights
2-No. 12 Convenience outlets
2-No. 10 Garage doors
2-No. 10 Bath room No. 1
2-No. 10 Bath room No. 2
2-No. 14 Hall and bed room No. 2 and 3
2-No. 12 Outlets bed room No. 2 and 3
2-No. 12 Lights bed room No. 1 and book room
2-No. 12 Convenience outlets
2-No. 10 Sun room and roof convenience outlets
2-No. 12 Sun room and roof lighting

Five circuit breakers and eight load centers are used here

Based on zero degrees F. outside temperature and 70 deg. F. inside temperature, the estimated requirements for heating the entire house are approximately 105,000 B.t.u. per hour. The total cooling capacity required for the entire house is estimated to be 53,000 B.t.u. per hour for 15 deg. cooling. The use of 1-in. insulation in the walls, 2-in. insulation in the room and double window glass accounts for the cooling load being smaller than usual for a house of this size. Year-round operation of the equipment for air cleaning and humidification, heating in winter and cooling in summer is expected to consume an average of 250 kw.-hr. per month.

A Carter-Korth oil burner and American Radiator steam boiler supply steam at 3 to 5 lb. to a Westinghouse air-conditioning unit containing steam heating coils, humidifier, cooling coils, motor-driven blower and air filter. The steam supply valve to the heat exchanger is controlled through the action of two thermostat bulbs, one located in the air stream entering the air-conditioning unit, the other located in the air stream leaving the unit. These work together to prevent underheating the house in cold weather and overheating it on mild days.

In the humidifier section a series of nozzles direct minute streams of water against carborundum targets that break them up into a fine mist, most of which is

Table IV—How 18 Kw. of Lighting Is Used in the Westinghouse Home of Tomorrow

Room	Size	Color of Walls and Ceilings	Type of Unit	No. of Units	No. of Lamps Each	Wattage of Lamps	Additional Local Units Watts	Total Watts	Intensity in Foot-candles
Entrance hall	11′x15′6″	Gray	Hex recessed	2	4	25	None	200	5
			Illum. mirror	1	16	25	None	400	25
Living room	15′x20′	Light brown flexwood walls, cream ceiling	Cove	2	28	50 (Mill type clear)	200	3,000	8
Dining room	12′x16′	Yellow and gray walls, cream ceiling	Rect.	1	14	25 white	50	1,620	10 white
			Recessed		8	40 blue			4 amber
			Corner brkt		8	25 amber			1 blue
			Flush wind.	4	1	25			
			Lite	4	6	25			
Breakfast room	8′x14′	White	Encl. globe	2	1	100	None	580	35
			Flush strip	1	6	50			
Kitchen	10′x14′	Yellowandwhite	Encl. globe	1	1	100	None	960	45
			Flush strip	2	6	50			
			Work Lite	4	1	45			
Kitchen passageway	3′x7′	Cream	Oct. flush	1	2	50	None	100	5
Cellar landing	3′x7′	Cream	Square flush	1	2	100	None	200	11
Garage	17′x20′	Plaster	Rect. flush with guards	4	2	100	150	950	10
Service entrance	3′6″x7′	Gray brick	Exp. rect.	1	2	60	None	120	3
Guest closet	3′x7′	Yellow	Rd. flush	1	2	50	None	100	5
Resident closet	2′x4′	Gray	Rd. flush	1	1	60	None	60	5
Broom closet	2′x2′	Cream	Rd. flush	1	1	50	None	60	5
1st floor toilet	3′9″x5′3″	Cream	Star-exp.	1	1	60	None	60	16
Side porch	7′x13′	Gray brick	V-shape exposed	1	2	75	None	120	4
Front entrance	.....	White	Rect. flush	1	5	50	None	250	19
1st floor landing	3′x7′	Gray	Rd. flush	1	2	60	None	120	9
2nd floor hall	3′x21′	Gray	Rd. flush	2	2	50	None	200	7
Master's bedroom	11′x13′	Blue and white	Illum. mirror	1	4	50	100	700	30
					16	25			
Master's bedroom closet	5′x6′	Gray	Rd. flush	1	2	50	None	100	7
Small bathroom	6′x9′6″	Yellow and green	Rd. flush	1	2	100	None	650	55
			Illum. mirror	1	5	50			
					8	25			
Guest bedroom	11′6″x15′	Chocolate and white	Illum. mirror	1	14	25	150	500	30
Guest bedroom closet	3′6″x6′	Gray	Rd flush	1	2	50	None	100	7
Linen closet	3′x3′	Gray	Rd. flush	1	2	50	None	100	7
Child's room	10′4″x11′3″	Blue and white	Rect. flush	1	1	25	75	100	..
Child's room closet	2′x3′	White	Rd. flush	1	2	50	None	100	8
Large bathroom	2′6″x11′6″	Black and gray	Rd. flush	1	2	100	None	750	55
			Rd flush	1	2	50			
			Illum. mirror	1	5	50			
					7	25			
Book room	8′x14′	White and red	Curved flush	2	2	50	100	1,000	30
			Flush strips	4	8	25			
Penthouse stair landing	3′x7′	Cream	Rd. flush	1	2	50	None	100	5
Penthouse	9′x12′	Cream and blue	Rect. flush	4	1	25	200	300	5
Sun roof	14′x30′	.....	Louver flush	4	2	40	None	320	1
Garage roof	19′x20′	.....	Louver flush	4	2	40	None	320	1
Cellar hall	5′3″x10′3″	Cream	Rd. flush	1	2	50	None	100	12
Weather room	15′x18′	.....	Rd. flush	4	2	50	None	400	5
Game room	15′x17′6″	Sand color	Rect. flush	2	3	100	None	1,200	22
			Triangular	4	3	50			
Laundry	14′x15′	Cream and gray	Sq. flush	4	2	100	None	800	15
Toilet and shower (basement)	7′3″x5′3″	Cream and gray	Rd. flush	1	2	50	None	100	7
Cellar closet	2′6″x3′	Cream and gray	Rd. flush	1	2	50	None	100	15
Fruit cellar	3′6″x10′	Cream and gray	Rd flush	1	1	60	None	60	7
Fuel room	6′6″x12′6″	Plaster	Rosette	1	1	100	None	100	..
Storage room	6′x10′6″	Gray and cream	Rd. flush	1	1	60	None	60	7
Garage front	.....	Gray	Rect. flush	2	3	100	None	600	15

NOTE:—A burglar light using a 25-watt T-6½ clear bulb is located in all rooms except closets — not included in above listing.

evaporated into the air passing through the unit. Temperature control of the house is obtained by varying the speed of the blower motor in the warming and cooling unit. When heat is demanded the fan runs at high speed, forcing a large quantity of warmed air through the house. As the heating demand decreases the fan speed automatically decreases. It operates continuously, however, at some appropriate speed.

A three-position switch located in the weather room controls electrically operated dampers to distribute warm air in winter and refrigerated air in summer. The cooling operation may be extended throughout the whole house or, in extremely warm weather, divided between the first floor for the daytime and the bedrooms for the night.

Although the estimated cooling capacity for the entire house is 53,000 B.t.u. per hour, the installed refrigeration equipment is planned to remove only 24,000 B.t.u. per hour and to cool only part of the house at one time. The system is designed so that the entire house can be cooled during early spring and late autumn. While it is planned to use mechanical refrigeration for the coming summer, the steam boiler is of sufficient capacity to operate a 24,000-B.t.u.-per-hour steam-jet cooling system if it is decided to substitute such equipment later on.

A word of caution——the description of the layout and the installed equipment is to be taken as of the present date. This is an experimental home intended to evolve progressively step by step toward the ideal electric home of five years hence. What America wants and can afford will be anticipated as far as possible so that the industry will be ready to meet the demands with equipment and with wired facilities. By no means is the present installation the ultimate.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Kelly and hope others will discuss industry questions here in a similar constructive vein—EDITORS.

W. G. Kelley says—

Plant Design Engineer
Commonwealth Edison Company

Safety rules should not hamper progress; statements of principles would help

If the electric light and power industry is to reduce rates or improve service during times such as the present, regulations which unduly restrict the industry from meeting changing conditions or availing themselves of the advance of the art should be eliminated. Such a condition now exists under the various safety rules for the construction of electric light and power lines.

The rules consist, for the most part, in specifications covering specific types of construction which have under certain conditions proved satisfactory. They ignore, however, the fact that under different conditions other types of construction have proved equally satisfactory in promoting safety and raise an inflexible barrier against changes in design tending to reduce costs or improve service.

Regulations should be so applied as to permit the exercise of judgment by the management in order to promote the rendering of adequate service at reasonable cost and to encourage the progress and development of the art for the best interests of all concerned. In order to attain this objective it should be recognized that any given principle of safety cannot be enforced by rigid rule to the exclusion of equivalent or alternate safety measures if available or when the progress of the art makes them available.

In general, the only conclusive guide in the selection of safety methods is experience with their use over a period of time, and in the interests of progress it is essential to encourage the use of new or improved methods of promising character. Any given principle or measure for adequately limiting hazards to life can usually be applied in several ways or by several different means. It is therefore obvious that we should not discriminate or prejudice one method as distinguished from another method if both satisfy the principle involved.

Where specifications are necessary for a single company or for two companies operating in the same locality, these may be formulated based on recognized principles by co-operation between the interested parties. Safety principles should be formulated so as to afford the maximum of latitude in choice of measures or devices consistent with safety.

Where safety of employees is concerned it must be realized that maximum safety can only be obtained by a combination of suitable clearances and a careful selection, training and supervision of workmen.

At the present time a number of restrictions exist that are retarding the advance of the electrical industry, among which is the rule prohibiting the interconnection between the transformer secondary neutral and the lightning arrester ground protecting the transformer. The use of this interconnection has shown marked decrease in transformer maintenance and service outages.

The rule prohibiting joints or taps in wire spans crossing railroad tracks was made for the purpose of guarding against injury to the wire by the use of hot solder. Since the advent of various types of connectors which can be applied without injury to the wire, this rule places an unnecessary restriction on the utility company.

Certain other rules relating to working space have been predicted on certain types of construction and have ignored the fact that other more economical types have been in use for many years and have proved to be equally safe.

A careful review of the experience in the construction and operation of electric light and power lines leads to the conclusion that the interests of all parties concerned would best be served if regulations for safety consisted of the principles involved rather than rules for specific types of construction.

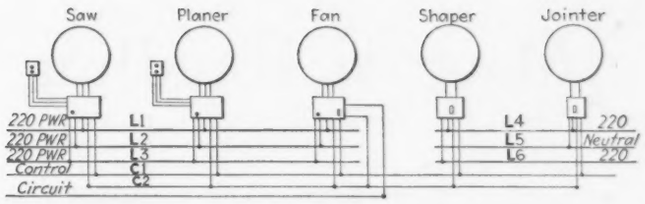
Interlinked Starters Protect Workers

Developed to correct the results of traditional forgetfulness by schoolboys, this resourceful expedient offers a way to protect workers on other operations

By IVAN C. WERTZ
Industrial Arts Instructor, Senior High School, Maplewood, Mo.

When a student in the woodworking shop of the senior high school at Maplewood, Mo., starts up a planer or other machine tool there is no chance for him to forget to start up the exhaust fan to drag away the dust and shavings. Neither can he forget to shut down the exhaust fan when he is finished with whatever tool he is operating. He can't forget the fan because he does not have to remember it. The motor control arrangement in the shop does this remembering for him. Since high school students have no exclusive copyright on forgetting, it may be that the exhaust fan control scheme used in this shop might find application in commercial establishments as well.

The scheme is simplicity itself. As shown in the accompanying diagram, it consists merely of extending the fan motor control circuit to automatic contacts in the starters of the motors on the woodworking tools. The motors on the saw and planer are three-phase with push-button control, normally requiring three-pole magnetic switches. Four-pole switches are used instead and the fourth sets of contacts close into the control circuit of the magnetic switch on the fan motor. The shaper has a 220-volt, single-phase motor equipped with a three-pole, instead of the usual two-pole, manual starting switch. The motor on the jointer is 110-volt, single-phase and it has a two-pole in place of a single-pole manual switch. These extra contacts in the starting switches are all in parallel on the fan motor control circuit, as is also a small toggle switch in the fan starter box. Closing any of these contacts thus energizes the operating magnet in the fan starter. So long as any of the tool motors are operating the fan continues to run. When the last one is shut down the fan stops unless it was started by the toggle switch in its own starter box. This switch is normally left in the open position and it would never be used except for starting the fan for a purpose other than operation of the woodworking tools.



Exhaust fan starter linked to other controls

New Chart Shortcuts Voltage Drop Calculations

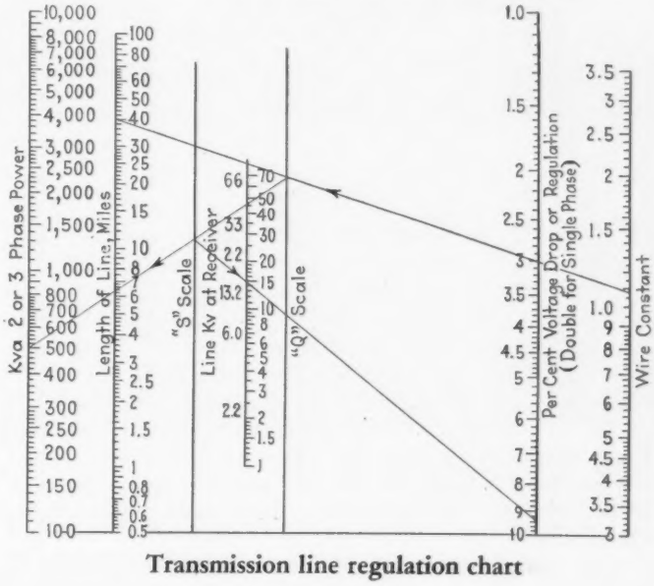
By B. E. ELLSWORTH
Engineer Iowa-Nebraska Light & Power Company, Lincoln, Neb.

Voltage regulation of a transmission or distribution line to an accuracy of at least two figures, which is accurate enough for most estimating and checking purposes, can be readily obtained from the accompanying chart. Reactance and resistance are taken into account in the design of this chart; however, electrostatic capacity is not, so the limit for high-voltage lines should be 100 miles.

The chart is almost self-explanatory. Select from the table the wire constant for the spacing, power factor and size of wire to be used. For No. 2 copper, 80 per cent power factor and 18 in. equivalent spacing, this constant is 1.07. Assume a 40-mile line. Lay a straight edge between this 40 and the 1.07 as found above, locating a point on scale "Q." Then between this point and the kva. load (500 kva.) lay the straight edge locating a point on the "S" scale. Between this point and the voltage of the line (1,500 volts) again lay the straight edge, locating a point on the "regulation" or voltage drop scale. The last point for the values given is 9.5 per cent, which is the regulation for a three-phase line. If the line is single phase, double this value. If one or two voltages are standard with a company, graphs for each voltage will be found to be very useful. Straight lines can be plotted for each size of wire and power factor used.

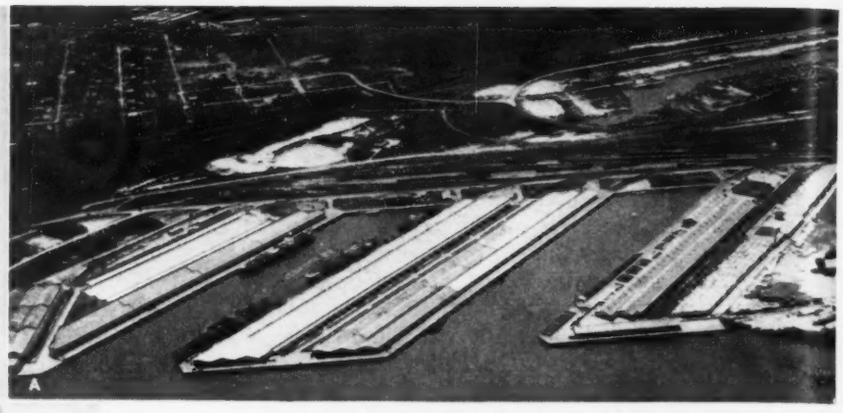
Wire Constants for Lagging Power Factors

Wire Size		Equivalent Spacing								
Copper	A.S.C.R.	80% P.F.			90% P.F.			100% P.F.		
		18"	36"	60"	18"	36"	60"	18"	36"	60"
#6	#4	2.15	2.20	2.24	2.26	2.28	2.30	2.23	2.23	2.23
4	2	1.49	1.53	1.58	1.51	1.55	1.58	1.40	1.40	1.40
2	0	1.07	1.12	1.15	1.05	1.08	1.12	.882	.882	.882
1	2/0	.919	.965	1.00	.888	.922	.952	.699	.699	.699
0	3/0	.797	.845	.894	.750	.790	.819	.555	.555	.555
2/0	4/0	.700	.752	.796	.655	.686	.718	.444	.444	.444
3/0	...	.622	.675	.718	.566	.600	.633	.356	.356	.356
4/0	...	.566	.621	.655	.513	.545	.566	.287	.287	.287


Kva 2 or 3 Phase Power
Length of Line, Miles
"S" Scale
Line Kv at Receiver
"Q" Scale
Per Cent Voltage Drop or Regulation (Double for Single Phase)
Wire Constant

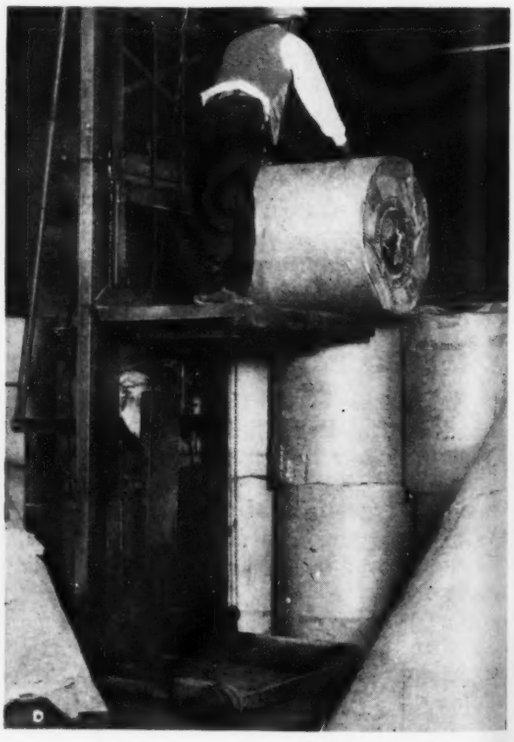
Transmission line regulation chart

Material Handling Speeded Many Ways



(A) Alabama spent $10,000,000 on these Gulf docks.
(B) Two 100-hp. motors operate this 75-ton derrick.

(C) Bulk cargoes loaded at 600 tons per hour.
(D) "Revolvator" piles newsprint rolls in transit shed.



Co-ordinated use of diversified forms of electric loading methods aids new Mobile docks to reduce handling interval.

WIDELY diversified forms of material handling by electrical means mark the new $10,000,000 State Docks at Mobile, Ala. Heavy machinery is loaded on steamers (deck or hold) by a 75-ton electric derrick which is powered by two 100-hp. motors. The coal and bulk material handling plant was constructed at a cost of $1,066,717. This has a maximum demand of about 350 kw. and is separately served from the main substation of the Alabama Power Company. Ocean-going vessels can take on fuel or cargo at the rate of 600 tons per hour and thus substantially reduce docking time.

The equipment at this 1,150-ft. wharf comprises a rotary car dumper, movable unloading tower, movable unloading and reclaiming tower, movable loading and stocking tower and belt conveyor system. These handle coal, coke, bauxite ore, phosphate rock or any other material that can be handled on a 42-in. conveyor belt. They are arranged to take care of the following movements: Car to vessel, car to storage, storage to vessel, storage to car and vessel to vessel. Weightometers on

the unloading tower automatically weigh material received at the plant by water and railway scales weigh that which arrives by rail.

Three 333-kw. transformers serve the 440-volt motors of the handling plant. Other power and light requirements are met by a 4-kv. underground line which is selectively fused by pole-type cutouts mounted in small switch-houses. Motor voltage is generally 220 except for the 110-volt small motors served from the 50-kw. lighting transformer.

A dozen or more tonnage-producing industries located on or near the docks have their own electrical equipment. The Dixie Portland Flour Company has an electrically driven flour sifting and sacking plant and the Docks Commission has installed an electrically motored flour reconditioning plant. The docks are also equipped with numerous belt and box conveyors, electric pilers and car loaders.

Waterproof outdoor sockets are located at frequent intervals beneath the ship-side edge of all wharves, permitting the vessels to plug in for lights and power when for any reason their own generators are not working. These outlets are also used by stevedores when deck and wharf lights are required for night work.

Photo-Cell Synchronizes Output and Conveyors

By introducing a simple photo-cell control on the production line of a rubber mill the uniformity of product was improved at low cost.

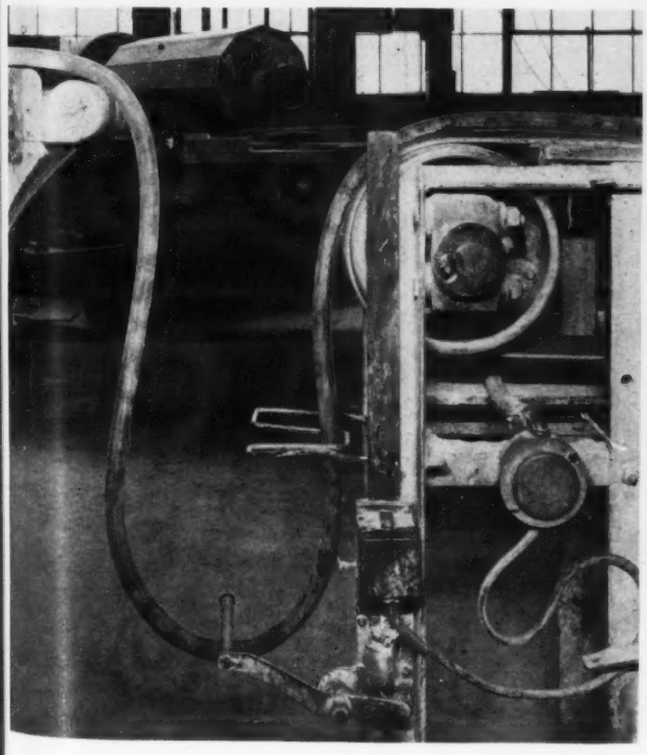
By J. D. CROBAUGH
Electrical Engineer Ohio Rubber Company

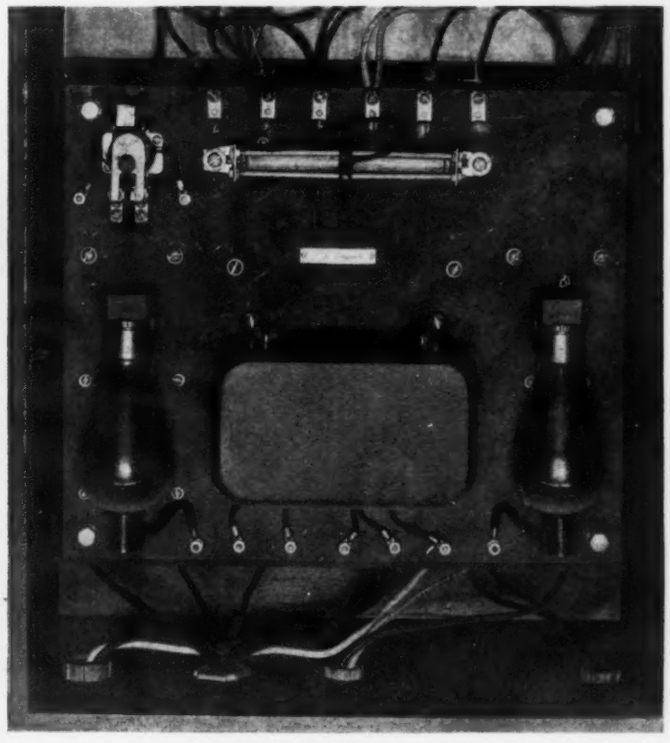
The output of one of the rubber-extrusion mills at the Willoughby plant of the Ohio Rubber Company is carried away by a take-off belt. If the latter travels faster than the rubber is extruded the stock will be stretched and changed in diameter, whereas if it travels too slow the stock will fall on the floor and become tangled. Owing to the different grades of mixture, temperature changes and varying rate of feed of the mill the speed of extrusion varies considerably at times.

Manual control of the conveyor speed was not convenient, so automatic synchronization of the take-off and extrusion speeds was adopted. This was accomplished as shown in the accompanying illustrations.

The extruded stock is allowed to drop in a loop between the tube mill and conveyor. Resting on the bottom of the loop is a roller attached to a pivoted arm actuating the plunger of a solenoid. This solenoid acts as a variable reactor in the grid circuit of a thyratron control for the field of the direct-current conveyor motor. If the slack between the mill and the conveyor increases or decreases the conveyor speed is raised or lowered. Regulation is so close that the roller on the loop does not move more than $\frac{1}{4}$ in. up and down to effect the proper take-off speed. The control is arranged so that the motor will not lose its field if a tube should burn out.

E. R. Tozer of the engineering staff of the Elliott Electric Company, Cleveland, Ohio, aided in solving this problem.





Equipment which controls conveyor speed

Thyratron control keeps slack between extrusion press and conveyor relatively constant

Telephone Interference Reduced by "Impedor" Application

By inserting a harmonic filter in the secondary neutral of a transformer bank serious interference on a Western telephone circuit was effectively eliminated.

To permit proper relaying during emergencies an automatic vacuum tube device is used to cut out the device during line troubles.

Just another instance of the effectiveness of new tools on an old problem.

SOME years ago the Pacific Telephone & Telegraph Company built a telephone line west from San Luis Obispo, Calif., to Moro on the coast and thence north around the coast to San Simeon, a distance of approximately 44 miles. Later when it became necessary to provide electric service along this same route an 11-kv. line was built by the Midland Counties Power & Light Company and extended north as the development of the country required, closely paralleling the telephone line. Extensions took place over a period of several years and at each extension the line was co-ordinated with the telephone company line. However, as the power line was extended and more taps to the main line were completed the noise on the telephone circuits increased to such a point that an investigation was made to determine the source of the interference and to effect a reduction of the same.

The first tests were of a general nature, during which all effects, due to connections with other substations, were checked and eliminated. Equipment at San Luis Obispo substation, origin of the 11-kv. line, was checked and found to be in good condition. Ammeter readings of the neutral current in the 70/11-kv. transformer bank serving this line showed that the 70-kv. neutral current was 1.7 amp. and the 11-kv. neutral current was 1.25 amp. Both of these readings were considered normal for a bank of Y-Y 500-kva. transformers. Analyses made on the telephone circuit to determine the predominant frequency of the interference showed an excess of the ninth harmonic current. An analysis of the 70-kw. neutral current showed that the ninth harmonic component of this current was smaller than the third harmonic, which is usually found to be the case. In the 11-kv. neutral the ninth harmonic current was greater than any other harmonic.

Inductive readings taken under different circuits leading from the substation showed that the ninth harmonic was predominant in only one line, the 11-kv. circuit to San Simeon. As this circuit is relatively long its impedance to the ninth harmonic frequency was very low, allowing a large 540-cycle current to flow with a small impressed 540-cycle voltage. Readings with an exploring coil taken under this line at various locations along the route verified this conclusion. The results, shown in Fig. 2, indicate that the current has a maximum value at San Luis Obispo and decreases gradually to zero at the outer end of the circuit.

At the San Luis Obispo substation there are two transformer banks in parallel on the 60-kv. line. Since one of these is connected star-star and the other connected star-delta, with all the star neutrals grounded, it would be

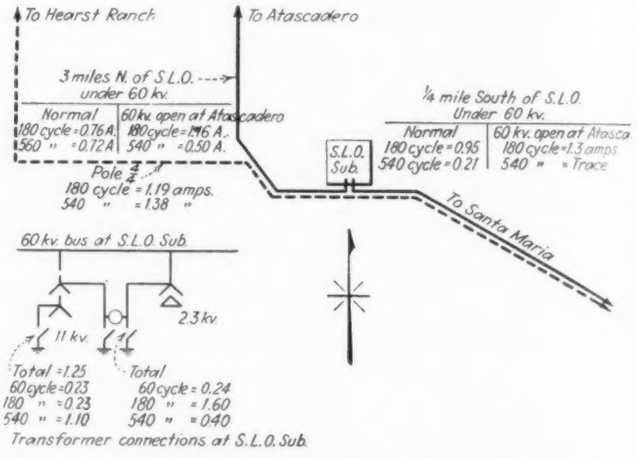


Fig. 1—Transformer connections and results of tests made to check noise-producing currents

Exploring coil tests made on line between San Luis Obispo substation and San Simeon.

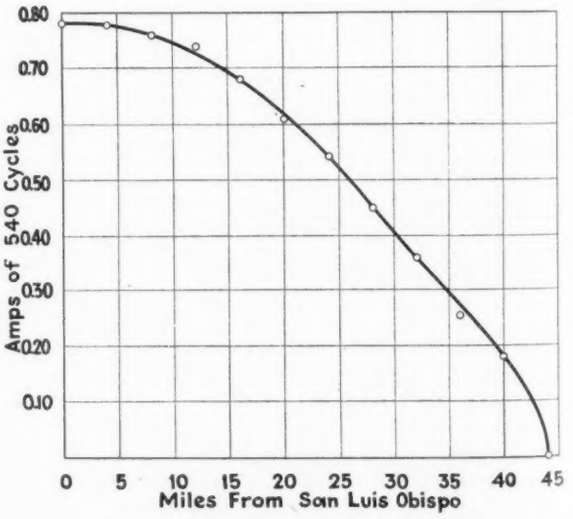


Fig. 2—Residual 540-cycle current measured under the 11-kv. line

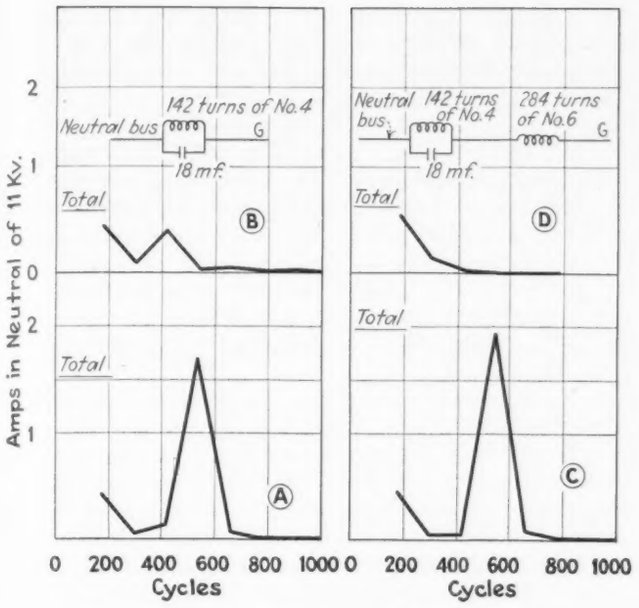


Fig. 3—Neutral current analysis of 11-kv. bus San Luis Obispo substation

(A) Neutral current before inserting impedor.

(B) Neutral current after installing the impedor shown. The 540-cycle current was reduced, but other harmonics were increased, especially the seventh, eleventh and fifteenth.

(C) Impedor out of the neutral circuit.

(D) With the impedor shown installed in the neutral the third and fifth harmonic currents were slightly increased, the seventh remained the same and all others were reduced, this combination producing the desired results.

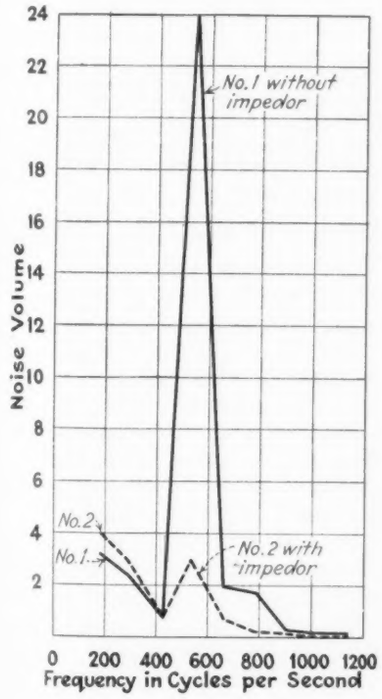


Fig. 4—Noise measurements on telephone line with and without impedor

Impedor is responsible for reducing the value of noise from the ninth harmonic to one-eighth of its original value. Noise measurements check the neutral current shown in C and D of Fig. 3.

expected that practically all of the current of the triple-frequency series required by the star bank would be supplied through the star-delta bank and that only a small amount of current at these frequencies would exist in adjacent lines. Tests, however, showed that although some of the current at the ninth harmonic frequency was supplied through the star-delta bank, the admittance of the 44-mile, 11-kv. line to 540 cycles was sufficiently low to permit a substantial amount of current in this path. It was doubtful, therefore, whether an increase of delta capacity (costing approximately $100,000) would be an effective remedial measure. Furthermore, the present transformers were of adequate capacity for several years, after which time it was planned to install a 70-kv. substation at the midpoint of the present line and raise the voltage of the line between the present and proposed substation to 70 kv. This, plus the fact that an additional tertiary bank would give no benefits other than the elimination of noise, made this remedial measure uneconomical.

Anti-resonant circuit the remedy

A second method would be to increase the impedance of the residual circuit of the 11-kv. line to the ninth harmonic frequency. To try this scheme there was connected in the 11-kv. neutral an anti-resonant circuit consisting of a low-ratio current transformer in multiple with a group of condensers, the whole circuit being tuned to 540 cycles. A substantial reduction of residual current at this frequency and a corresponding reduction of telephone noise was obtained by this means. Because of the charging of the impedance of the iron core inductance with the charge of neutral current this improvised anti-resonant circuit could not be made satisfactory. These tests showed, however, that an anti-resonant circuit properly constructed would be an effective means of reducing the noise. It was decided, therefore, to use such a means as a permanent remedy.

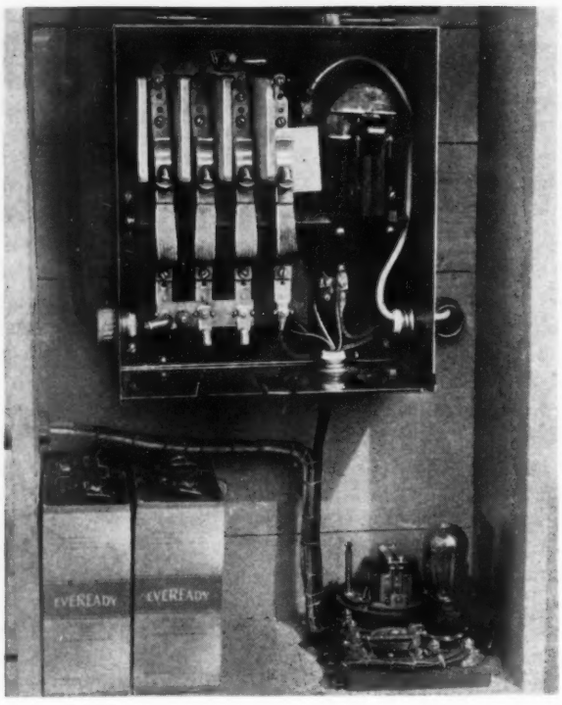
Any "impedor" applied to the 11-kv. neutral should be of a rather low impedance to 60-cycle current in order that the proper protection may be afforded for the operation of the line switches. Also, the impedor must be able to withstand the stresses that would be imposed upon it during times of circuit trouble, or some means should be provided to take the impedor out of the circuit automatically. This latter method seemed the best for the following reasons:

1. The telephone circuit would be noisy during the time of power trouble even with the impedor in the circuit.
2. With the impedor in the neutral it would reduce the short-circuit current and greatly affect the operation of oil switches.
3. With the impedor out of the circuit the utmost protection to power circuits would be obtained.
4. With an automatic impedor cut-out it is possible to allow a higher impedance in the impedor, thus providing a greater reduction in noise in the telephone circuits.

From design formulæ and the few very brief discussions on large air-core inductances it was decided to start with a coil of about 5 millihenrys. This was designed with a mean diameter of 18 in. and a length of 24 in. After tests one was arrived at with 284 turns of bare No. 6 soft-drawn copper wire being wound in four layers on hard maple forms bolted together with brass bolts. Iron angle braces which were used in the first experimental coil to back up the maple supports were omitted in the final coil because they produced an unexpectedly high effective resistance and low impedance.

Due to the fact that previous tests had shown the presence of a 900-cycle component, it was deemed advisable to have two impedor coils so any frequencies that might be found on the final installation could be suppressed. A second coil was built with the same dimensions, but with only two layers of bare No. 4 soft-drawn copper wire instead of No. 6.

The impedor coils were mounted on an old lightning arrester base about 7 ft. from the leg of the steel structure supporting the 11-kv. neutral bus. First the two-



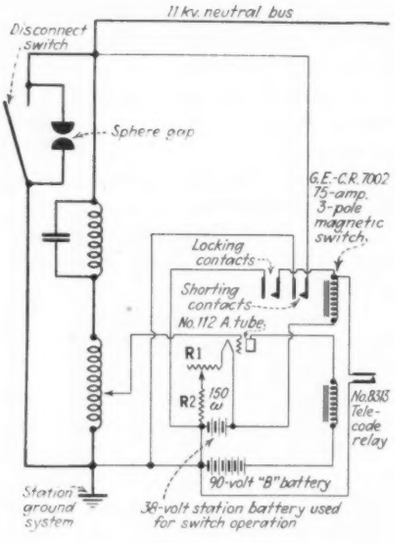


Fig. 5—Vacuum tube relay used to cut impedor out of neutral circuit during periods of trouble on the line

layer coil was installed and turned with approximately 18 mfd. of condensers at 540 cycles. Results of subsequent tests are presented in Figs. 3 and 4.

To cut the impedor out of the neutral circuit during line faults, so that relaying will function promptly, the vacuum-tube relay represented in Fig. 5 was developed, to be operated from the station 36-volt storage-battery. This relay was to close a three-pole short-circuiting switch on the impedor.

Two tests were desired to check the operation of the protective equipment in case of line faults, one with an arcing ground and one with a solid ground or short. For this purpose one phase of the 11-kv. circuit, about 2½ miles from the substation, was connected to a 30-amp. fuse holder mounted just below the crossarm and the lower end of the fuse holder attached to a No. 4 copper wire long enough to drag on the ground. This was pulled back free from the ground by a "hot-tap" rope and the fuse put in place. The rope was then allowed to slack until it dangled on the surface of the ground and grass, producing an arcing ground which blew the fuse and operated the protective relay. For the solid-ground test a No. 2 copper wire was run from a 1-in. ground pipe driven 6 ft. into moist soil to the base of the pole, where the fused tap from the 11-kv. phase could be brought in contact with it as before. This time the sphere gap on the disconnect shorted before the protective relay could operate. The gap had been set at 14 mils, which was rather close. The gap was opened to twice this setting and left. The condensers used were the telephone type, which accounts for the low setting of the spark gap. With high-voltage condensers the gap setting will be further increased.

It should be understood that this is no cure-all for all cases of inductive interference. However, it is felt that it is the best and most economical solution of this case or any similar case where the impedance of the line and the capacitance to ground is such that it closely approximates a series resonant condition for some frequency which is troublesome. Where the frequency is generated in undue amounts it is not so economical a solution due to the fact that too much power would have to be absorbed in the impedor. This would mean high voltages across the coils and across the condensers and would therefore involve severe short-circuit switching difficulties.

Electric-Steam Generator Supplements Refuse Plant

Unconventional use of a conventional electric boiler saves a Western lumber company $30 to $40 a day when the refuse supply is too low for adequate incidental supply of its sawmill refuse plant.

At the Red River Lumber Company, Westwood, Calif., power is supplied by a hydro-electric generating system in conjunction with a steam power plant burning sawmill refuse. Exhaust steam from the latter is used in the dry kilns and, in times when lumber production is low, there is a shortage of hogged fuel, so that the necessary amount of steam is not available for drying without resorting to burning oil. As the power requirements for the mill under low production conditions can be supplied by the company's hydro system and still leave an appreciable margin of excess capacity, an electric-steam generator was installed to utilize the excess hydro power.

Electrode-type boiler used

The steam boiler, built by the Bigelow Company, New Haven, Conn., is rated at 2,200 kw., three phase, 60 cycles and is of the electrode type. It has an upper and lower chamber, the upper chamber being devoted to steam generation, while the lower is used as a storage space or a self-contained hotwell and is similar to those steam generators discussed in ELECTRICAL WORLD September 2, 1933, pages 317-318. Three electrodes, rigidly supported by the roof, extend down into the upper chamber. Current-carrying rods

enter through specially designed insulator bushings. Normally, the electrodes are submerged in the water and a three-phase current, flowing between them through the water, generates the steam. Variation of the water level will vary the resistance of the water, and hence provides a simple means of regulating the steam output either by hand or automatic methods. Steam is generated at 175 lb. pressure, the boiler having a quick pick-up because of conserving hot water in the lower chamber. Approximately 10 kw. is necessary to develop 1 b.hp.

Savings from the installation, which is one of the largest electric-steam generators in the country, are conservatively estimated to be between $30 and $40 a day, depending upon the amount of oil that otherwise would have to be used to make up the steam requirements of the plant when the hogged fuel supply was low.

Co-ordination of Standard Controls Adequate in Quick-Reversing Service

It is not always necessary to go to specially designed equipment (control, motors, starters and brakes) in order to accomplish the many varied control functions that are increasingly being applied in new machine designs.

Quite often the desired result can be obtained by using a suitable combination of the wide variety of facilities already available in standard patterns. This article shows how the job was done for a quick reversing cutting machine requiring semi-automatic control.

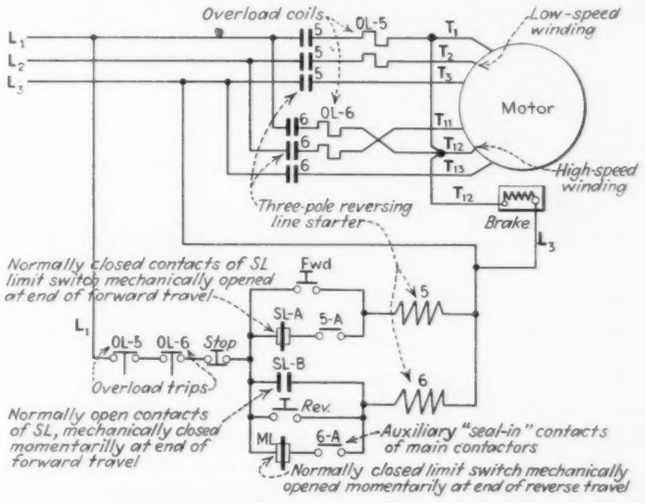
By V. B. WILFLEY
Engineer Westinghouse Electric & Manufacturing Company, Portland, Ore.

NEW machine designs must be watched closely in order that proper consideration be given to the possibilities for electric drive and control. It is also important that standard equipment be used whenever possible, provided such use does not involve sacrificing either effectiveness or efficiency of the machine. From the standpoint of cost and reliability, standard equipment will be of advantage to the machine designer and maker and to the ultimate user of the machine or of its products, as well as to the electrical manufacturer.

An example of such standard-equipment application is found in the case of a new box-shook cutter, or "equalizer," as it has been named, designed by F. W. Horstkotte, consulting engineer of Portland, Ore., and his associate, Thornton Fay, and installed in the new box mill constructed at Cathlamet, Wash., by the International Wool Products Company, a subsidiary of the Kraft-Phoenix Company.

The cutter, the function of which is to cut shook of proper length for making boxes for cheese packing, is made up of a flat table approximately 11 ft. long, 5 ft. wide and 2½ ft. high, upon which is mounted a saw arbor and a movable carriage. The saw arbor has four 24-in. circular saws on a common shaft extending across the table, the saws projecting a suitable distance above the table surface and being adjustable as to side spacing. The carriage is arranged for a lengthwise movement on the table of about 5 ft. and is fitted with push arms spaced between the saws in such a way that bundles of shook may be carried through the saws and to any desired distance beyond.

The thin shook boards are first assembled into rough bundles, approximately 30 in. long, 10 in. wide and 9 in. deep and wired securely in such a way that the wires pass between the saws. When a bundle has been laid in place and passed through the four saws three evenly trimmed, secured wired bundles are deposited by the carriage on the table to the rear of the saws. These bun-



Only standard equipment used for quick reversing, braking and overload trip on this box-shook cutter drive

At the rear end of the cutter table a type "SL" limit switch is located so as to be operated mechanically by the carriage at the end of its forward travel. A contact is broken to drop out the "forward" contactor (5) and a second contact made to energize the "reverse" contactor (6) to reverse the carriage and return it at double speed to the front end of the cutter platform. In repassing over the "SL" limit switch the carriage resets it to its original condition. When the carriage reaches its starting position, a type "ML" switch is mechanically opened to stop the motor and set the brake. The carriage is then at rest until the operator sets a new shook bundle in place and presses the "forward" button to begin a new cutting operation.

Each contactor has a set of auxiliary-closing contacts (5-A and 6-A), which function to maintain closed circuits to the operating coils after the "forward" button in the case of (5) and the limit switch contacts, SLB, in the case of (6) have been opened after a momentary contact. Contactors (5) and (6) are mechanically interlocked in such a way that only one can be closed at a time. The overload contacts (OL-5 and OL-6), also the "stop" button contacts, are connected in such a way that opening of any one of them drops out both contactors.

dles are pushed onto a belt conveyor by the next group for removal to any desired point. The lengths of the three bundles can be set for any desired value by proper adjustment of the saw spacing.

Briefly, the advantages of cutting and equalizing in the manner described above as compared to the old method of cutting and trimming one board at a time are reduced labor cost, since one man can do the work of several; increased speed of production and better uniformity in length, which results in more satisfactory boxes.

The saw arbor is motor-driven through belt and pulley at about 2,000 r.p.m. and runs continuously during the working period The choice of electric drive was a natural one. With reference to the carriage drive, however, consideration was first given to the use of a cylinder using steam, water, oil or air in line with standard practice for saw mill carriages. A study, however, indicated that electric drive would be satisfactory and, at the same time, would be less expensive in first cost and in operation, would require less maintenance and would permit better control.

Arrangements were made to operate the carriage from a motor-driven drum, around which is wound four or five lengths of flexible cable, with the two ends of the cable attached to the two ends of the carriage. The drum and drive are mounted beneath the cutter and carriage and suitable pulley arrangement was made to insure smooth operation and the maintenance of tension on the cable.

Two-winding gearmotor is the drive

The driving unit is a type "FD" gearmotor which fitted in well with the space limitations due to small dimensions obtainable by having motor and gear in one case. The unit is direct-coupled to the drum and drum speeds of 20 and 40 r.p.m. are obtained by use of a two-speed two-winding motor of the standard squirrel-cage hoist-duty type. The carriage operates to move the shook into the saws at the lower speed, but returns to its original position at the higher speed, thus speeding up production.

Though a larger frame size was involved, the two-winding motor was chosen in preference to a two-speed single-winding motor to simplify the automatic reversing and speed-changing control. A motor-mounted brake is supplied.

A form of control was desired which would be automatic to the extent that manual operation would be required to initiate a cutting cycle, after which the operation would be automatic until the equipment came to rest ready for succeeding operations. As devised it is simple and standard control parts are used. The principal item is a three-pole reversing line-starter which functions to change the speed and reverse the gearmotor. Changes necessary in wiring the starters and the addition of an overload relay for the extra winding of the motor are easily made in a few moments time by the customer when wiring in the equipment.

A "stop, forward and reverse" push-button station is included, though normally only the "forward" button is used. However, the carriage may be controlled by the push-button station if non-automatic operation should be necessary.

The present semi-automatic operation can be easily expanded to permit successive cutting cycles continuously with no action required by the operator and with any desired time interval between operations.

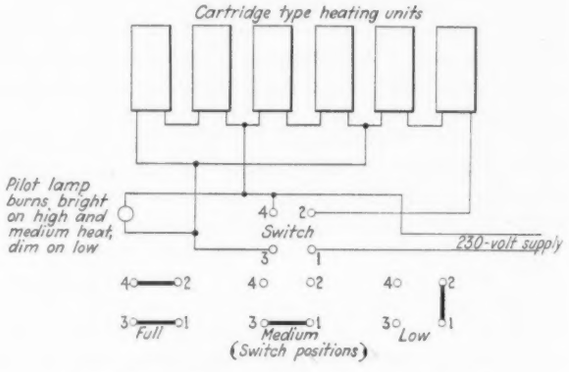
· · · INDUSTRY

Electric Heat Ages Whiskey

Amateur producers of allegedly potable spirits in Chicago, and probably elsewhere as well, have discovered a new application of small unit electric heaters. Whiskey concentrate is kept at a temperature of 140 deg. F. for several days by means of an immersion electric heater inserted in the bunghole of the classic charred keg. The effect is a rapid acceleration of the rate of esterification —in English, aging.

Brush Handles Cemented Faster by Electric Heat

From 160 to 350 brush handles per hour are cemented with the aid of electric heat at each of fourteen 2-gal. units in the factory of the Fuller Brush Company, Hartford, Conn., depending on the type of brush and handle required. "Asbestos insultine," a kind of cement wax, is employed in the process. The cementing ma-



Wiring scheme provides three heats for melting compound

PRACTICES IN BRIEF · · ·

terial is brought to a temperature of from 260 to 300 deg. F. for attaching the wire carriers of the brushes to ivory handles, the temperature range used in wooden brush handle work being from 300 to 350 deg. Each pot is equipped with six General Electric No. 151-C 200-watt cartridge units rated at 115 volts and operated with the two units of each pair always in series. A 230-volt, four-point snap switch connects the three pairs in parallel for high heat, drops out one pair for medium heat and connects two pairs in series for low heat.

The original pots were built some years ago by the Hartford Electric Light Company for wax melting for experimental purposes. Their successful use led the brush company to adapt them to specialized service, and the company's branch factories in all parts of the world are now provided with this means of melting insultine material. The fire hazard associated with gas flame heating of such melting pots and the discomfort of using combustible heat sources over the work benches have been eliminated. The process has been made cleanly and a beginning has been made in the application of automatic temperature control on one or two pots, using a Bristol recording thermometer with Sundh relay and magnetic switch to open and close the single-phase, 220-volt supply circuit to the pot. A 16-cp. carbon filament pilot lamp at the rear of the pot indicates when the energy supply is on or off. To prevent excessive radiation the pots are provided with a 2-in. covering of asbestos cement and fitted with covers. A $\frac{3}{4}$-in. solid copper rod extends for $6\frac{7}{8}$ in. upward from the center of the pot to facilitate even distribution of the heat through the insultine.

The melted binding material is drawn from the pot through a brass gas cock controlled by a pedal mounted close to the floor, leaving the operator's hands free to hold the brush handle and wire carrier at the time of filling. The cock is heated sufficiently from the cartridge units in the bottom of the pot to keep the cementing material from cooling too much during its passage from the pot into the brush handle channel or pocket in which it sets. About $1\frac{1}{2}$ hours is required to heat each pot to running temperature in the morning and the units are switched into service by the night watchman or another attendant to be ready for the day shift. A $\frac{3}{8}$-in. sheet of asbestos is mounted on the front of the pot to increase the comfort of the operator. The leads to the cartridge type units are insulated by threading $\frac{3}{16}$x$\frac{3}{4}$-in. upon them and the units themselves are only $2\frac{1}{4}$ in. long x $\frac{3}{4}$ in. in diameter. They are installed to a slightly loose fit when cold and expand under heating to tight fit.

Non-automatic melting pot for cementing brushes into handles

Portable Arc-Welding Sets Make Good Pipe Thawers

General Electric

Severity of the past winter, with its record sub-zero temperatures, taxed customary facilities for pipe thawing and brought into the limelight electrical methods for that purpose. Arc-welding equipment, because of the high currents at variable low voltage which it is capable of supplying to a variable load resistance such as is met in the different lengths and sizes of pipe from job to job, is well suited to the work and many experienced welding men with portable equipment, such as that shown, have taken advantage of the emergency harvest by merely extending their cables and providing clamps to connect to the pipes.

There are no set rules for the job and automatic control is hardly feasible because every job differs according to length, size and kind of pipe, so experienced judgment alone can meet the approximate requirements. It has been the experience of some users that 250 amp. will thaw a $\frac{3}{4}$-in. pipe 300 ft. long in from three to ten minutes, and again that a 3-in. pipe 100 ft. long will take nearly an hour before a current of 500 amp. passed through the frozen section will give results. It is a good example of the application of equipment to a job for which it was not designed, but for which it is nevertheless peculiarly adapted.

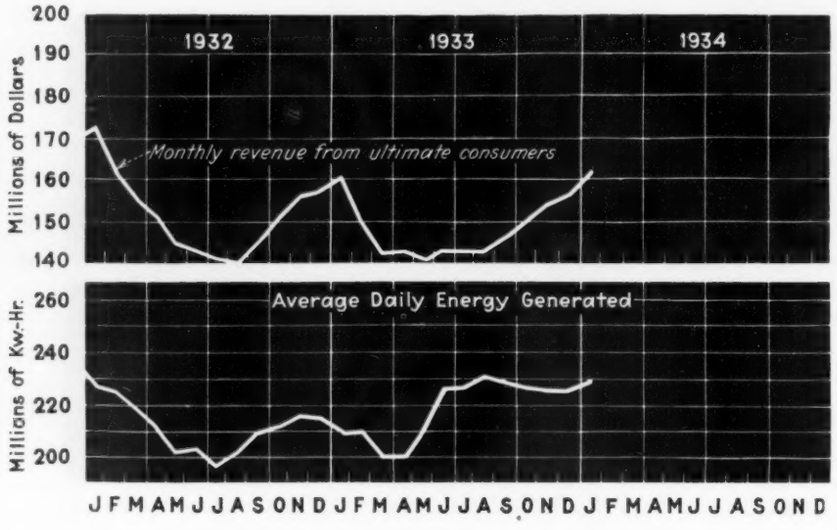
Light and Power More Active

JANUARY revenue received from ultimate consumers for light and power was 1.1 per cent greater this year than in 1933, and energy output increased 9 per cent. After three months of revenue smaller than a year ago, the new figure of $162,070,000 overshoots last year's peak, with the highest revenue in nearly two years, though less than in January of 1933. Meanwhile, the average daily output rose slightly over December, which is unusual, although it did not fully match the best months of last summer.

Thus the story continues as in the recent past—sales well above those of the corresponding months of the year before, as to energy, but with little additional revenue in compensation for the increased consumption.

Analyzed by classes of consumers, it will be seen from Table III that the chief increase over 1933 continues to be in the quantity of wholesale energy sales, which rose 17 per cent. Domestic and retail commercial consumption rose more than 3 per cent, compared with about 1 per cent in December.

Regional gains seem to reflect quite definitely the improvements in the East North Central industrial area, with an increase over last year of 2.1 per cent in revenue and 16 per cent in energy output; approximately equal gains were made in the West South Central region, where oil production is an important industry.



New features in monthly statistics

With this issue the allocation of energy sales to various classes of ultimate consumers is introduced as a new feature of the monthly summary of operations of the electric light and power industry. This will bring out, month by month, the relative changes of domestic and commercial sales, compared with similar sales a year ago.

When the ELECTRICAL WORLD began collecting monthly statistics intercompany transactions were relatively small. Revenue derived from them was logically included in the amounts reported. For about twenty years ELECTRICAL WORLD has consistently published statistics on that basis. More recently this item has been segregated in the quinquennial U. S. census, and in the monthly statistics announced by the Edison Electric Institute it is eliminated. In the statistics appearing on this page revenue from ultimate consumers replaces total revenue as heretofore given.

Reported operating and maintenance expenses necessarily include payment for energy purchased from other companies. This item, then, is not comparable with revenue statistics from which the corresponding income of the selling company has been omitted, and is being discontinued.

Table I—Monthly Revenue from Ultimate Consumers and Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1934	Revenue from Ultimate Consumers		Energy Generated, Millions of Kw. Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
January	162,070	+ 1.1	7,130	+ 9.0	2,789	− 1.2	4,341	+17.2
1933								
December	156,127	− 0.9	6,986	+ 5.0	2,559	0	4,427	+ 8.3
November	153,980	− 1.8	6,788	+ 4.4	2,330	−12.6	4,458	+16.3
October	150,390	− 0.8	7,025	+ 6.5	2,427	− 3.0	4,598	+12.3

Table II—Regional Revenue, Energy Output, in January, 1934

Compared with Corresponding Month of Previous Year

Geographical Region	Revenue from Ult. Consumers		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
United States	162,070	+ 1.1	7,130	+ 9.0	2,789	− 1.2	4,341	+17.2
New England	14,362	+ 1.7	514	+15.5	244	− 3.6	270	+40.8
Middle Atlantic	49,193	+ 0.4	1,870	+10.2	639	+15.3	1,231	+ 7.7
East No. Central	37,062	+ 2.1	1,718	+16.0	122	−24.7	1,596	+20.6
West No. Central	13,745	+ 1.4	445	− 7.1	87	−45.6	358	+12.3
South Atlantic }	19,718	+ 0.7	871	+ 3.9	473	−14.5	398	+40.0
East So. Central }			288	+13.1	237	+14.0	51	+ 9.0
West So. Central	8,542	+ 2.8	328	+15.0	18	+139.0	310	+11.8
Mountain	4,545	+ 1.4	222	+19.5	174	+29.0	48	− 4.2
Pacific	14,903	− 0.1	874	+ 3.0	795	+ 4.4	79	− 8.7

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central station.

Table III—Allocation of Energy, January, 1934

Compared with Corresponding Month of Previous Year

Class of Service	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution*	7,131	+10.0
Lost in transmission, etc.	1,220	+10.1
Sold to ultimate consumers	5,911	+10.0
Domestic	1,244	+ 3.2
Com'l, small light and power	1,162	+ 3.7
Com'l, large light and power	2,748	+17.3
Municipal street lighting	222	− 5.2
Railways—street and interurban	396	+ 9.8
Railroads—electrified steam	62	+25.9
Municipal and miscellaneous	77	+28.8

*Generated, purchased from other sources and imported less energy used in railway and other departments.

LETTERS TO THE EDITOR

Simplified Meter Mountings

To the Editor of the ELECTRICAL WORLD:

In your issue of February 24 there appeared a letter by A. E. Silver, E.E.I. electrical equipment committee sponsor, upon the subject "Simplified Meter Mountings Under Study by E.E.I." Certainly no one could be better qualified than Mr. Silver to comment on this subject, and in commenting on this letter it should be understood that the writer is in sympathy with the program under discussion by Mr. Silver.

In the second paragraph of his letter occurs the following statement: "As the change from open to inclosed wiring systems progressed developments in meter cabinets and inclosures provided a means of accommodating an open wiring device, the meter, to an inclosed wiring system. This has proved to be an unsatisfactory compromise."

We believe that Mr. Silver intended to convey the idea that for future installations and new meters meter cabinets and inclosures are an unsatisfactory compromise, but we also believe that it might be well to point out in connection therewith the fact that the meter cabinet and inclosure as a means of adapting old and existing meters to inclosed wiring systems is satisfactory and has so been pointed out by the subcommittee on meter mountings, of which O. K. Coleman is chairman.

R. C. FRYER,
Manager Electrical Division.

Corcoran-Brown Lamp Company,
Cincinnati, Ohio.

Sheath Troubles With Only 0.2 per Cent

To the Editor of the ELECTRICAL WORLD:

I wish to take exception to the published statement on page 356 of the ELECTRICAL WORLD for March 10, 1934, reading, "Troubles, says the user, come from 20 per cent of cable sheath." Evidently some one has misplaced the decimal point, as the figure works out to be 0.19 per cent of the cable purchased for the New York Edison Company and affiliated companies during the period 1926 to 1933 inclusive, as indicated below:

Extent of Lead Defects in H.T. Paper-Insulated Cable During Two-Year A.E.I.C. Guarantee Period

Year	Ft. Purchased	No. of Defects	Feet Involved
1926	2,335,719	..	.....
1927	2,515,241	4	1576
1928	3,736,307	4	5131
1929	4,376,588	5	1931
1930	3,359,854	5	3037
1931	1,608,340	12	5747
1932	1,939,607	34	18590
1933	529,143	6	3100
Total	20,400,799	70	39,112

The lead defects covered by the above tabulation include nail holes, thin lead, eccentric lead, dross in lead, laminated lead, split lead, improper alloying in one case of adjacent turns of cable freezing together. In every case the defective cable was either releaded or replaced by the manufacturer.

The large number of defects shown for 1932 was due to fourteen lengths of aerial cable totaling 9,800 ft. from one manufacturer, which were releaded because of improper mixture of tin alloy.

DAVID WILLIAMS,
Assistant Purchasing Engineer.

Cable Division
New York Edison Company.

[Mr. McCorkle in his paper said all sheath troubles came from 20 per cent of the cable.—ED.]

Some Rate Structures Discourage Energy Use

To the Editor of the ELECTRICAL WORLD:

Energetic business development points the way out of many current utility troubles. Lack of financial ability, imagination and business courage are evident in too many local situations. Wages create business opportunity, and the restoration of many individuals to the payroll, even if compensation is small in specific cases, enlarges markets for service. The time is ripe for auditing local sales possibilities, especially in the residential field. This would help lift local and headquarters managements out of depression ruts which are worn deeper than usual by years of difficult conditions.

In an instance which I recently came across a householder and his wife are using 50 to 60 kw.-hr. per month. They own a modern electric range and water heater, but cannot economically use these because the lowest bracket rate in the town is 3½ cents per kilowatt-hour. This couple utilized electric cooking and water heating when residing in city territory and are predisposed to heat by wire today, but if *they* do not utilize the local service, what can be expected from the native sons and others.

The utility serving the above community purchases energy for distribution to about 6,000 homes in a territory 30 miles square. The $5 or $6 per month received from the above couple probably affords little profit to the company, but if the rates induced the use of the idle range and water heater fully 300 kw.-hr. would be added per month at, say, 2 cents each with no appreciable addition to the utility plant. Even if this added energy cost the company 1½ cents per kilowatt-hour it would realize a net profit of $18 a year on the ½-cent margin. If by proper inducement rates 10 per cent of the residences came to use this fuller service the increased profit would be $10,000 a year. I do not see how any real gain in home service net can be enjoyed until the present usage of 720 kw.-hr. per year is increased. Supplemental use brackets should offer low enough prices to bring out the patronage of customers with small incomes as well as that of the few more fortunate customers. Since time is required to yield the benefits of competent market analysis and promotional rates, aggressive sales effort must be coupled with attractive prices in order more quickly to reach volume consumption. Now is a good time to re-examine rates and their effects as well as to put real promotional prices into use in areas which have as yet failed to realize that here is a key capable of unlocking many doors leading out of commercial blind alleys into the broader avenues of success.

NORMAN T. WILCOX.

Melvin Village, N. H

NEWS OF THE WEEK

Walsh Sees Power Plans Undelayed by Treaty Vote

Defeat of the Great Lakes-St. Lawrence Treaty in the Senate "will not seriously delay the accomplishment of New York's public power project," Chairman Frank P. Walsh of the New York Power Authority told President Roosevelt last week (ELECTRICAL WORLD, March 17, page 414). Mr. Walsh assured the President that the power authority, whose services were loaned to the federal government by Governor Lehman, would continue to co-operate with him "to assure early completion."

"It should be possible," Chairman Walsh said, "to reach a complete agreement among the several government agencies involved well within the current year. Unnecessary obstruction and delay will cause an enormous waste of cheap power and deprive consumers of millions of dollars in electric rates."

In a memorandum accompanying the pledge of the authority's co-operation Mr. Walsh said there were 8,722,417 retail consumers whose savings "might reach more than $200,000,000 a year by the use of a public power yardstick on the St. Lawrence River."

T.V.A. Appliance Plans Advance

New refrigerator designs submitted. Revised prices accepted. Effort to buy Knoxville utility continues. New cities sign power contracts.

SUBMISSION of new refrigerator and range designs, further development in the proposal to purchase Tennessee Public Service Company's Knoxville property and the signing of power contracts by four more Alabama cities marked the week's activities on the T.V.A. front.

General Electric Company has submitted to the Electric Home and Farm Authority a radically new design of refrigerator in response to the call of David Lilienthal, E.H.F.A. president, for high-quality appliances to be sold at low prices in the Tennessee Valley area (ELECTRICAL WORLD, March 17, page 414). The new refrigerator submitted by General Electric is combined with an electric range, also new in design, forming a compact "electric kitchen" unit. "We have tried to meet your requirements by making an entirely new approach in design," said T. K. Quinn, vice-president of General Electric, in submitting the unit. "We are reducing costs in anticipation of greater volume, and at the same time improving the quality and durability of the product."

Revised price proposals accepted

Mr. Lilienthal stated that he had also received definite assurances from a number of other manufacturers that totally new designs for refrigerators and ranges are under way in their plants. He has announced acceptance, pending early submission of new designs, of revised price proposals made by Kelvinator Sales Corporation, Frigidaire Corporation and the Leonard Refrigerator Company on standard refrigerators. Kelvinator expects to submit to E.H.F.A. an entirely new design early next month. Confidence that prices of refrigerators as approved for the valley market will be between $70 and $80 was expressed by Mr. Lilienthal. Recently lowered rates in the valley localities served by private utilities will make it possible for the $10,000,000 customer-credit established for E.H.F.A. to be extended through most of the valley and also in some adjacent zones influenced by the T.V.A. rural electrification program, Mr. Lilienthal indicated.

To investigate Knoxville value

To help T.V.A. in determining what a fair price for the property of the Tennessee Public Service Company would be, the Federal Trade Commission has sent two accountants to Knoxville to investigate the company's property accounts. Without authority of its own to demand access to the books, the only reports available to T.V.A. are those furnished by the Knoxville company to its parent, National Power & Light Company. These are very sketchy and inadequate, according to Mr. Lilienthal, particularly with respect to new capitalization which appeared during a merger in 1930. "The ways of mergers are mysterious and T.V.A. ought not to go in as a buyer until it knows what there is to buy," said Mr. Lilienthal. He expects that within a week the Trade Commission will have all the facts needed.

At a conference several weeks ago the utility expressed a willingness to sell its entire properties both within the city and adjoining territory to T.V.A. (ELECTRICAL WORLD, March 3, page 345). It was understood that the offer of the utility proposed that T.V.A. purchase the outlying properties and Knoxville those within the city. An offer by the city to buy the utility's Knoxville properties for $2,500,000 was rejected by the power company. The city has a P.W.A. grant of $2,600,000 with which to buy existing facilities or construct its own distribution system.

Alabama cities sign contracts

Contracts for the Tennessee Valley Authority to furnish electric energy from the Wilson Dam hydro-electric plant to Sheffield and Tuscumbia, both in Alabama, were signed recently, providing for the wholesale purchase of energy, carrying the 10 per cent discount given Florence in an earlier contract. Decatur and Russellville, Ala., also signed contracts. Power contracts signed to date include:

Contracting Party	Date
Tupelo, Miss.	Oct. 27, 1933
Commonwealth & Southern. Alabama Power Company. Georgia Power Company. Mississippi Power Company. Tennessee Electric Power Company	Jan. 4, 1934
Knoxville, Tenn.	March 1, 1934
Florence, Ala.	March 6, 1934
Pulaski, Tenn.	March 8, 1934
Sheffield, Ala.	March 14, 1934
Tuscumbia, Ala.	March 14, 1934
Decatur, Ala.	March 14, 1934
Russellville, Ala.	March 14, 1934

New Accounting System Permanent for New York

Failure of the Consolidated Gas Company and its affiliates to obtain a rehearing in proceedings in which the New York Public Service Commission directed all New York utilities to set up a new uniform system of accounting will make permanently effective the commission's order, originally set for January 1 and postponed to April 1 (ELECTRICAL WORLD, February 17, page 272).

The new system, which would "inform the consuming public and stockholders of the true condition of their properties," requires that accounts for operating properties must be carried at original cost and that all classes of utilities use the "straight-line method in ascertaining the annual rate of depreciation" instead of the retirement reserve method now generally employed.

Lehman Broadcasts Appeal for His Utility Program

Urging prompt passage of his utility program by the Legislature, Gov. Herbert H. Lehman of New York went "to the people" this week in a state-wide radio broadcast. The Governor in his address gave an explanation of the provisions contained in his public utility bills, the objectives he was seeking to attain and the abuses on the part of the public utility corporations, which he declared had led up to and rendered the proposed legislation indispensable for the protection of consumers. Declaring that the utility companies would be the gainers rather than the losers if his program became law, the Governor accused the utilities of "carrying on a concerted effort to frighten the small and frequently uninformed investor" and of maintaining unusual lobbying activity in the Legislature.

Carlisle broadcasts reply

Describing Governor Lehman's utility program as destructive to private investment, Floyd L. Carlisle, chairman of the Niagara Hudson Power Company and of the Consolidated Gas Company of New York, replied to Governor Lehman's radio speech with a half-hour broadcast on Wednesday of this week. With the major part of his attack centered on the proposals for encouraging municipal ownership, Mr. Carlisle stated that "if there is to be written into the laws of this state a municipal ownership bill without requiring a taking over of the properties, then obviously the purpose must be either to duplicate the present existing plants or, by reason of that threat, to acquire the existing property at a knockdown price upon the theory of that price or nothing. Where, in heaven's name, is there any protection for existing investors in this state, as proposed?" he queried. Citing a long list of rates in communities served by municipally owned utilities, Mr. Carlisle showed that those rates were higher than those charged by private utilities in comparable communities. The temporary rate bill was denounced as setting up "an entirely illegal base for making temporary rates."

Utility Votes Pay Rise

Announcement was made this week by Thomas N. McCarter, president of the Public Service Corporation of New Jersey and its subsidiaries, that, effective April 1, all operating company employees would receive a salary increase equal to 5 per cent of their pay before July 1, 1932. On that date and in April, 1933, salaries were reduced a total of 15 per cent. Restoration of part of the pay cuts was made, Mr. McCarter said, "in keeping with the spirit of the times and with the efforts to stimulate the return of better economic conditions by adding to the purchasing power of the people."

Engineers Study Performance Data

E.E.I. Cleveland meetings also analyze transmission, generation, and distribution costs. Progress toward insulation co-ordination.

MARKED by the presentation of a wealth of data on costs and service performance, engineering committees of the Edison Electric Institute met in Cleveland this week. With revived activity and interest in engineering indicated by an unusually large attendance, papers and discussions in each committee were supplemented by considerations of organization for better work.

Three aspects of the meetings stood out. One was the great amount of information presented on cost and service performance of the apparatus and assemblies used on utility systems. Poles, turbines, boilers, fuses, cables, breakers and other devices were surveyed as to performance, costs and new developments. A second basic interest was the presentation of data and studies of the cost of transmission, generation and distribution, with a relative weighing of results obtained by several types of design. A third item of note was the intense interest devoted by engineers to dollars invested and dollars spent in operation. At the meetings many new developments in apparatus were presented and discussed and further work in standardization was accomplished.

Wave and insulation values agreed on

Coincident with these meetings, a joint committee of N.E.M.A. and E.E.I. arrived at an agreement upon laboratory waves and insulation values for insulation co-ordination. The major high-voltage laboratories agreed to use a 1x5 and a 1½x40-microseconds wave and agreed upon positive wave flashover values for both insulator strings and rod gaps. This decision permits three levels of insulation for each line. One is based on the impulse rod gap values, another on 80 per cent of arrester value and a third upon 100 per cent of arrester value. This step goes far toward the solution of the insulation co-ordination problem.

BUT THEY DIDN'T STOP THE STATION

More than 30 tons of small fish were taken from the revolving screens of the condensing water intake tunnel of Ohio Public Service Company's Lorain, Ohio, generating station on the shore of Lake Erie in the space of two hours recently. Heavy runs, mostly of fresh water herring, failed to curtail station operations.

Insull in Chicago Jail

Almost refused entry to the United States by immigration officers, then admitted after a half-day squabble, Martin J. Insull arrived in Chicago this week to stand trial. Unable to obtain bail, Insull was lodged in the Cook County jail. Meanwhile Samuel Insull's chartered freighter *Maiotis*, with "one passenger" aboard, arrived late this week in Istanbul.

Coming Meetings

Association of Iron and Steel Electrical Engineers—Youngstown, Ohio, April 12. J. L. Kelly, Empire Building, Pittsburgh.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 19-20, R. N. Beagle, 101 W. High St., Jefferson City, Mo.

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Atlantic City, N. J., May 14-18. A. R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer Convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 429 Lexington Ave., New York.

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

A.S.M.E. Proposes Plan to Fund Bank Loans

Unwilling to sell at a sacrifice approximately $125,000 of guaranteed mortgage bonds held by banks as collateral for loans, the American Society of Mechanical Engineers has proposed a funding plan to reduce outstanding bank loans by that amount. Under the refinancing plan, members of the society are asked to purchase certificates of indebtedness in amounts of $100 and multiples thereof, bearing interest at 4 per cent. Ten per cent of the issue is to be retired annually, beginning in 1936, and the balance in 1944, the society undertaking to provide that amount from current income.

The issue will be secured by guaranteed real estate mortgages or mortgage certificates or equivalent securities in face value equal to the amount of certificates of indebtedness issued, the proceeds of the sale of certificates going only to retire bank indebtedness.

Large Generating Section of N.E.M.A. Proposed

Subject to approval of N.E.M.A.'s board of governors, a new industrial section of the association has been formed to be known as the "Large Generating and Converting Apparatus Section." The scope of the new section will include the following: Waterwheel generators, all ratings and capacities, both vertical and horizontal shaft; synchronous condensers, all ratings; frequency converters of standard frequency, odd frequency converters and phase changers of ratings larger than 150 kw. at 80 per cent power factor; synchronous converters, 100 kw. and larger; mercury-arc rectifiers of all ratings and voltages; power tube rectifiers of all ratings and voltages; direct-connected turbine-generators, all ratings up to and including 2,000 kw. at 80 per cent power factor.

N.E.M.A. member companies considered eligible to membership in the new section include Allis-Chalmers Manufacturing Company, Crocker-Wheeler Electrical Manufacturing Company, Elliott Company, Electric Machinery Manufacturing Company, Fairbanks, Morse & Company, General Electric Company, Ideal Electric & Manufacturing Company and Westinghouse Electric & Manufacturing Company.

Northwest Planning Group Studies Bonneville Plans

With the vision of an orderly co-ordinated development for all the natural resources of the region the Pacific Northwest Regional Planning Conference has just completed a three-day discussion under P.W.A. auspices in Portland, Ore. Public power projects offered the dominant theme. The net result of the meeting was a broad recommendation that the national program of advanced planning be carried out through state planning boards, responsible for state-wide projects, other than federal, which shall stimulate, direct and aid other local planning boards.

Hogan points to fallacies

Despite the absence of tangibility in the recommendations of the conference, attended by 1,600 representatives of the four states, much interest centered around the economic use of Bonneville and Grand Coulee power.

Col. John P. Hogan, consulting engineer and a member of the consulting staff on the Bonneville Dam project, stated that stimulation of industrial development is the key to the sale of Bonneville power.

"There are suggestions for hundreds of miles of 220,000-volt transmission lines," Colonel Hogan said. "Building a transmission line into the desert of Sahara will not sell any power, and the builder would inevitably go bankrupt. Transmission lines should be built only for a demand that exists or can be created, and of a sufficient size only to satisfy that demand. They should be self-supporting, and if the demand increases beyond expectation they can be economically enlarged. The logical initial step is to take some of the power to Portland, where it can be economically distributed either through existing facilities or by a modest system of independent lines, if the people so elect."

Who will use the energy?

On the assumption that 2,800,000,000 kw.-hr. at Bonneville is commercially available and that this power were to be distributed among 800,000 people who could be economically reached, it would require a consumption of 5,000 kw.-hr. per year per person, Colonel Hogan reasoned. Even in New York State, with Niagara Falls and a highly industrialized population, only 1,000 kw.-hr. per capita per annum is consumed in all industrial and commercial use. In the consideration of industrial development, power investment is only the beginning.

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Willkie Addresses A.I.E.E.

In addressing a meeting of the New York section of the A.I.E.E. late last week, Wendell L. Willkie, president of Commonwealth & Southern Corporation, discussed the public and private utility situation with emphasis on T.V.A. and the co-operation of the Southern operating companies of his organization with it. His remarks, chiefly in amplification of his exclusive statement to ELECTRICAL WORLD (page 463), were offered with restrictions as to further publicity. In the general discussion which followed there was an air of old-town-meeting excitement for a time. Familiar and well-worn arguments in favor of government operation of the utilities were propounded by New Dealers. Questions arising from the recent publication of high salary

MERRY-GO-ROUND

Hope is beginning to be entertained by those sponsoring the electric light and power code that they may finally win the fight in which they have been engaged so long. The principal difficulties have revolved around differentials in wages and hours in small towns and isolated stations, extra hours for employees whose principal job is to be on hand if anything happens, and the bringing of appliance sales departments under the retail code. There is still no promise, however, when final approval may be expected.

The judiciary committee of the House was scheduled to meet late this week to consider the Johnson bill, already approved by the Senate, providing for the limitation of jurisdiction of federal courts in utilities cases. A favorable report on the bill was expected.

While the so-called municipal bankruptcy bill is having tough sledding, prospects favor the approval of the amendment to the bankruptcy laws which would allow two-thirds of the security owners of a private corporation to agree to a plan of reorganization. Minority owners would be required to abide by the decision. An amendment increasing the required majority to three-fourths may prevail.

PAUL WOOTON,
Washington Correspondent

lists of utility holding companies and injected by an opponent of the private utilities were easily and effectively refuted by Mr. Willkie.

Western Projects Approved by Reclamation Bureau

Construction of a hydro-electric plant in connection with the Elephant Butte and Caballo dams at an estimated cost of $2,500,000 to $3,000,000 has been favorably reported upon by engineers for the United States Reclamation Service, provided a market can be found for the power generated. The survey was made at the request of El Paso County Water Improvement District No. 1 and Elephant Butte Irrigation District (ELECTRICAL WORLD, February 10, page 238). The hydro-electric development program will involve increasing the height of the proposed Caballo Dam and the construction of transmission lines at a total additional cost of approximately $3,000,000.

By increasing the storage capacity of Caballo Dam an all-year power system would be made possible by the more uniform release of water throughout the year from Elephant Butte Dam. During the winter months the water would be held in the higher Caballo Dam for release during the irrigation season. This would permit generation of 92,000,000 kw.-hr. of firm energy (year-around power) per year at Elephant Butte Dam without waste of water.

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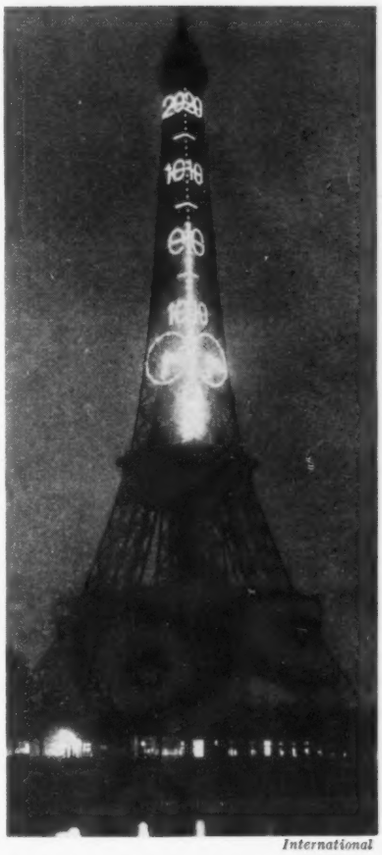
Electrochemists' Program

Devoting its two main sessions to discussions of "dielectrics" and "refractories," the spring convention of the Electrochemical Society will be held jointly with the American Ceramic Society on April 26-28 at Asheville, N. C. Announcement of the program for the meeting discloses that two mornings have been set aside for joint discussions on recent developments in such fields as linings for electric furnaces, high-voltage insulators, chemically resistant glass, etc. With headquarters for the convention at Grove Park Inn, members of the societies will have ample time during the meeting for trips to neighboring mines, manufacturing plants and hydro-electric installations.

Municipal to Rent Ranges

Joining the growing ranks of power and light companies, both public and private, to offer consumers rental facilities of heavy-duty appliances, the municipal Water, Power and Light Department of Glendale, Calif., has announced a range trial and sales plan which contemplates renting 500 ranges at a rental charge of $1.50 per month and a minimum trial period of six months. Payment for the period of the trial is to be made in advance. Wiring is to be free in old homes and a $20 allowance will be made to cover wiring expense in newer homes. A flat commission of $10 is granted dealers for trial installations.

LIGHT HAS A NEW JOB ON THE EIFFEL TOWER



International

Probably the world's largest thermometer, this spectacular lighting on the Eiffel Tower in Paris now flashes at intervals nightly telltale messages of temperature to weather-conscious Parisians. Supplementing automobile manufacturer Citroen's illuminated clock, the huge figures of the thermometer are variable, so that as balmier weather arrives higher temperatures, Centigrade scale of course, may be recorded.

Lights for Forbidden Lhasa

Even the forbidden city of Lhasa has yielded to the electrical age. General Electric Company reports negotiation of a contract for the installation of electric lights throughout that Tibetan city. Under the terms of the agreement, dated "The 21st day of the fourth month of the Water Bird year," all equipment must be "laid down" at Calcutta in cases weighing a maximum of 80 lb. each. This restriction, imposed because of transportation difficulties, resulted in reduction of the 6,000 yd. main cable to 300 cases, each containing 23-yd. lengths. Experts await at Lhasa to piece together this electrical jigsaw puzzle.

Spillway Plans Changed for Bonneville Project

A third major change in plans for construction of the Bonneville Dam project was announced last week, with the discovery by army engineers that ample foundation at a higher elevation for the Ogee spillway section existed at a point 3,000 ft. downstream from its original site (ELECTRICAL WORLD, November 18, page 644.) The new spillway section will be 1,200 ft. long, and it is not known whether it will contain the 22 50-ft. lift gates originally planned for it or a lesser number. The change will effect a saving of roughly two to three million dollars and will speed the time of construction, since work may be started during the low water period of this year instead of 1935.

The two previous plan changes in the project were a shift in the design of the locks from tandem type to a single lift lock and the shifting of the power house site, between Bradford Island and the Oregon shore, 200 ft. upstream to place it on a basalt ledge, thus eliminating considerable excavation which would have been necessary at the original site.

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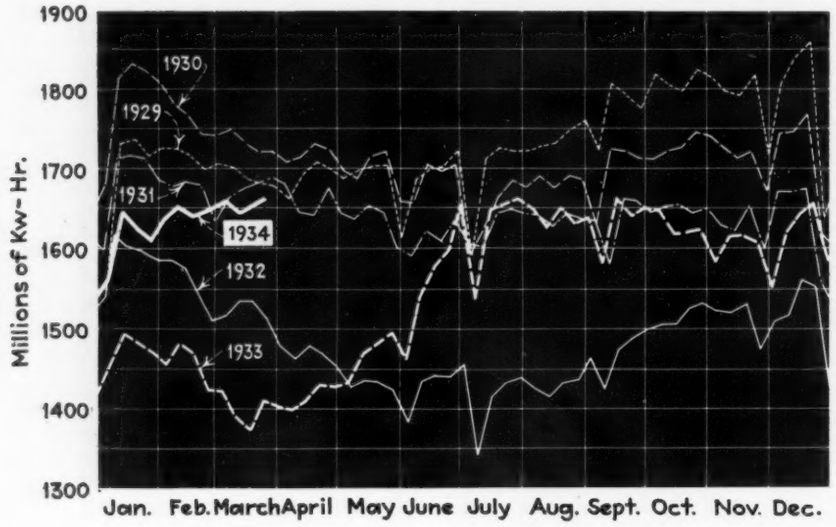
G. B. Cortelyou Honored

George B. Cortelyou, president of the Consolidated Gas Company of New York and of the Edison Electric Institute, was the guest of honor at a dinner given March 26 at the Union Club by the trustees and officers of the Consolidated system in celebration of the twenty-fifth anniversary of his connection with the company. Upon reaching his office, he found his desk covered with flowers and in the course of the day received many congratulatory messages on his long service. Mr. Cortelyou became president of the company in 1909, two weeks after he had retired as Secretary of the Treasury in the Roosevelt Cabinet. He is 72 years of age.

Consumption High Reached

An all-time high point in kilowatt-hour sales per residential customer was reached in February by the Alabama Power Company, when the system's annual average touched 801.1. Previous high was 799.8 kw.-hr. in October, 1932, the company reports.

Weekly Output Continues to Rise



With an output of 1,658,389,000 kw.-hr., during the week ended March 24, according to the Edison Electric Institute, central-station operations continue to accelerate their pace. The announced figure is the highest thus far in 1934, although the excess over the previous high point of March 3 is too small to have any significance.

The gain over the corresponding week of 1933—first recovery week after the bank moratorium—stands at 17.6 per cent; over 1932 the margin has grown to 9.5 per cent. The record for the week in any year was set in 1930. The present output lacks only 3.7 per cent of equaling it.

As in the preceding week the greatest rate of increase occurred in the Central Industrial area, now 27 per cent over last year. New England has been steadily increasing its lead over 1933, now up to 19.2 per cent. All other regions except the West Central also show large advances.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Mar. 24...1,658	Mar. 25...1,410	Mar. 26...1,515
Mar. 17...1,650	Mar. 18...1,375	Mar. 19...1,538
Mar. 10...1,647	Mar. 11...1,391	Mar. 12...1,538
Mar. 3...1,658	Mar. 4...1,423	Mar. 5...1,520
Feb. 24...1,646	Feb. 25...1,426	Feb. 27...1,512

Per Cent Change from Previous Year

Region	Week ended Mar. 24	Mar. 17	Mar. 10
New England	+19.2	+18.2	+17.0
Middle Atlantic	+12.7	+14.7	+14.1
Central Industrial	+27.0	+30.1	+27.6
West Central	+ 3.4	+13.8	+12.7
Southern States	+12.1	+17.5	+18.5
Rocky Mountain	+18.4	+16.8	+15.7
Pacific Coast	+12.3	+12.0	+ 7.9
United States	+17.6	+20.0	+18.4

Lightning Flashes Timed

High-speed photographs recently taken with a special revolving camera for the lightning investigation committee of the South African Institute of Electrical Engineers reveal flash velocities ranging from 14,900 to 68,400 miles per second, the average being but 15 per cent of the speed of light. According to Dr. B. F. J. Shonland of Cape Town University and H. Collens of the Victoria Falls & Transvaal Power Company, who conducted the tests, observed stroke lengths varied from 1.6 to 4.7 miles. Usually the main flash was preceded by a "leader" varying in length from 80 to 370 ft., with an average of 180 ft., and having a velocity range of from 2,810 to 19,900 miles per second. After the leader or "electron avalanche" struck the earth the main flash started upward over the identical path just traversed, requiring from 44 to 65 microseconds to reach the cloud. The camera also furnished information on the duration and direction of each discharge, and the persistency of luminosity. Further tests are to be made.

Belgium Has 80,000-Kva., 3,000-R.P.M. Generator

What is probably the largest single-shaft turbo-generator in the world operating at 3,000 r.p.m., is the 80,000-kva. unit recently built by the Siemens-Schuckert Works, Berlin, for the power station of the Société Interescaut at Schelle, Belgium. The machine generates energy at 10,500 volts at 75 per cent power factor. The rotor presented a problem in stresses; it is made of a rotor core and two flanged-on shaft ends of heat-treated nickel-chromium steel of ultimate strength of 46.3 tons per square inch. The rotor has a factor of safety against peripheral stresses of 216 at rated speed. Cooling is effected by turbo-blowers arranged on the generator shaft outside the stator housing and a recooler is traversed by the air before it enters the generator. By measurement of losses the efficiency is 97.2 per cent at rated load and power factor.

Soviets Finish Vast Turbo-Generator Factory

The great Kharkov turbo-generator plant of the U.S.S.R. has been completed and is now in operation, according to the *Economic Review* of the Soviet Union. The annual capacity of the plant is scheduled to reach 1,500,000 kw., which will include the production of six turbo-generators of 50,000 kw. each, eight of 100,000 and two of 200,000. The plant has eight departments equipped with 471 modern machine tools, of which 121 were designed and constructed in the Soviet Union. It also includes Russian electric furnaces with ratings ranging from 20 to 2,000 kw. The Kharkov plant is completely mechanized and will employ a maximum of 2,700 workers. Its cost, excluding auxiliary departments, exceeds $39,000,000, and it is scheduled to produce about $10,000,000 worth of equipment this year.

Pumped Storage Plant Started in Sweden

Recently placed in service, the Sillre power station of the Swedish Royal Board of Waterfalls on the Indal River in northern Sweden has the highest operating head of any hydro plant in the country and is the first pump storage installation as well. The three units of the station have a rating of 12,000 kw. total output; two of them are generators with pumps and the third a generator alone. At present one combined unit only is in operation. The water is brought to the plant from a small lake situated 645 ft. above the units through a double tunnel 9,850 ft. long. Plant operation is controlled from the Norrfors station, nearly 125 miles away, which plant also supplies the power during nights, Sundays and holidays to pump water back to the lake.

British Output Rises

Registering an increase of 16.5 per cent in electricity generated, February figures released by the British Electricity Commission show that 1,343,000,000 kw.-hr. was generated by authorized undertakers during that month, against the 1933 February figure of 1,152,000,000 kw.-hr.

As to Rates——

• Northwestern Electric Company's protracted rate case was continued recently with Charles M. Thomas, Oregon public utilities commissioner, fixing the valuation of the company's property in Oregon at $9,412,827 as of December 31, 1932. Evidence presented in the hearings by the company tended to place the valuation of this property at approximately $13,800,000. The commissioner indicated this order would be followed by one fixing lower electric rates based on his revised valuation. This case has been in progress in its many phases since April, 1928.

• Northern States Power Company electric rates in St. Paul would be cut substantially under the terms of an ordinance introduced recently in City Council by Mayor Mahoney. The Mayor said the schedules would cut residential rates about 20 per cent, commercial rates 15 per cent and industrial rates 5 per cent. The measure was submitted as an emergency ordinance which would go into effect immediately if approved when it comes up for final passage in 30 days. St. Paul recently voted down a bond issue to finance the construction of a municipal plant (ELECTRICAL WORLD, March 10, page 378).

• Kansas Power Company has announced a reduction of approximately 10 per cent in the power rate for certain classes of irrigation power in western Kansas.

• Indiana & Michigan Electric Company's charges for electricity in the city of Mishawaka, Ind., have been termed "disproportionately high" in a survey just submitted to City Council by Mayor Petro. If the city should find it feasible to construct an electric power plant, the survey pointed out that a plant using steam turbines would cost $570,000 and a Diesel engine plant $520,000.

• Missouri Utilities Company has filed a new schedule of rates for fifteen central Missouri towns, reducing charges for residence and business lighting service. The rates for residence service under the new schedules, which go into effect April 1, are reduced from 10 cents to 8½ cents per kilowatt-hour on the first block, 7 cents to 6 cents per kilowatt-hour on the second block and from 3½ to 3 cents per kilowatt-hour on the third block. Similar reductions are also made for business lighting service. These rates, together with a reduction put into effect February 1, will reduce the company's annual gross revenue $22,000.

• Colorado Public Utilities Commission has ordered hearings on the status of depreciation accounts carried by electric light and power companies in the state. Hearings, which commence April 30, will reveal charges of the commission that many companies are making excessive charge-offs to depreciation, with the result that "the consumer has been forced to pay rates which are high enough to produce large enough amounts to put into the depreciation account sums which can then be used for expansion. The amounts spent on expansion have then been charged to capital investment, upon which the consumer is forced to pay a return." The commission has no jurisdiction over rates in Denver and some of the other large centers of the state.

Municipal Items

DANVILLE, VA.—Resubmission of the question of borrowing $3,000,000 from the Public Works Administration for the construction of a municipal hydroelectric plant received a definite setback last week with the disclosure that P.W.A. has allotted $1,336,600 of the original $3,000,000 grant to the State of Virginia for various other projects. The proposal was recently defeated in a referendum (ELECTRICAL WORLD, March 3, page 347). Another referendum on the original contract between the city and the federal government on the project could not be held within a year, but a new contract would constitute a new proposition, it is contended by proponents of the plan.

WISCONSIN—Ten cities and two villages in Wisconsin will vote April 3 on proposals to establish municipal projects, according to the Wisconsin Public Service Commission, which also has twelve applications from cities and towns to acquire utilities now privately owned. Among the cities voting at the April 3 elections are Fond du Lac, which will decide on purchase of Wisconsin Power & Light Company's local electric distribution system, and Cambridge, which, having voted to purchase the local unit of that company, will clear up controversial legal points which have prevented consummation of the purchase. Milwaukee has before its voters the question of establishing a $14,000,000 light and power plant, Madison of purchasing the Madison Gas & Electric Company, Neenah of purchasing the local distribution system of Wisconsin-Michigan Power Company, Peshtigo the distribution system of Wisconsin Public Service Corporation, Superior the distribution system of Northern States Power Company and Waupaca the Waupaca Electric Light Company.

The commission has recently issued a ruling prohibiting members of governing bodies of cities, towns and villages from serving on management boards of municipal utilities.

PLAINVIEW, TEX. — An injunction perpetually restraining the city from carrying out a contract entered into early this year for construction of a municipal light and power plant has been issued by Federal Judge James C. Wilson in Fort Worth. The injunction was granted to the Community Power & Light Company, holder of approximately $8,000,000 in bonds of the Texas Utilities Company, which supplies Plainview and 51 other South Plains towns with electric current. The court ruled that the holding company had a right to ask injunctive relief because of its financial interest in the operating concern. Judge Wilson held that the contract finally entered into with C. S. Lambie & Company on January 26 for construction of the plant in exchange for $415,000 in revenue bonds was illegal and void.

FORT WORTH, TEX.—City Council has indefinitely postponed the calling of an election to vote on the proposition to construct a municipal electric light and power plant. This action was taken as the result of an opinion by City Attorney R. E. Rouer, who held that the petition for the election which had been presented to the Council was invalid.

MIDDLESBORO, KY.—Request of the Kentucky Utilities Company for an injunction to prevent the city from building a municipal power and light plant with P.W.A. funds has been refused by Circuit Judge J. M. Gilbert. By agreement of counsel, the case will be taken before the Kentucky Court of Appeals for decision. The city and the company have been at odds for months. Previous injunctions prevented the company from stopping service for city lights and power and the city from seizing the company's property for back taxes. City Council recently refused to renew the company's franchise.

CORNING, IOWA — City Council recently rejected all bids on construction of a municipal light and power plant and distribution system estimated to cost $144,200.

KNOXVILLE, TENN. — City Council awarded a contract to Burns & McDonnell of Kansas City to draw plans and specifications for a municipal power distributing system. The city has signed a contract with the the T.V.A.

RICHMOND, VA.—Question of establishing a municipal electric light plant will be considered at a meeting of the ordinances committee of City Council on April 19, it was indicated at a recent session of the utilities committee. A paper before the committee calling for a bond issue of $5,000,000, to be used exclusively for the construction and improvement of electric production and distribution facilities by the city was tabled.

FINANCIAL · · · BUSINESS

Associated G. & E. Denies Division by Affiliate

Asserting that any instances of profits made by Associated Gas & Electric Securities Company at the apparent expense of Associated Gas & Electric Company were without significance, the utility holding company struck back at the testimony of Trade Commission Examiner Charles Nodder before the Federal Trade Commission in Washington last week regarding the company's activities. Charging that the securities company threw $176,000,000 into trading on the New York Curb Exchange between 1926-29 to support its issues, Mr. Nodder testified that 70 per cent of the trading during the four years was in class A stock, which the parent company "sold" to the security affiliate at an arbitrary price of $35 per share, and that the security company then disposed of the stock to the public or affiliated companies at prevailing prices.

How the security company sold large blocks of stock to units in the utility system controlled personally by H. C. Hopson, president and treasurer of the security company and vice-president and treasurer of Associated Gas & Electric Company, was told by the examiner.

That Associated Gas & Electric Securities Company's market transactions in its parent's class A stock were directed toward placing its securities in the hands of permanent investors and removing them as far as possible from the hands of speculators, was the contention of W. A. Hill, representing Associated Gas & Electric Company.

"This could only be accomplished by absorbing the floating supply and placing it in non-speculative hands through the medium of the redistribution plan described by the examiner," Mr. Hill stated. "A considerable part of the report is devoted to a minute examination of transactions with certain corporate stockholders of the Associated Gas & Electric Company. Stripped of details, the report discloses that no cash has been withdrawn from the Associated Gas & Electric system by means of these transactions, that apparent paper profits, which less-conscientious managements might legitimately have made the basis of permanent fortunes, have been completely forgone, and that in several instances corporate stockholders have voluntarily assumed large losses, to the distinct financial benefits of the Associated Gas & Electric Company."

CRISIS PAST?

Uncertainty over labor-business relationships has been but partially dispelled by the automobile industry's "Peace Without Victory." Meanwhile latest figures of trade volumes continue on encouraging levels. Electrical energy production rose fractionally over the previous week to a point 17.6 per cent above last year's figure and within 3.7 per cent of 1930's same-week high. Automobile output at 81,896 units is 2,000 units above the previous week and 316 per cent of corresponding 1933 production. Lumber output for the week ended March 17 was higher than the March 10 week, orders for hardwood exceeding production. Steel receded slightly to 45.7 per cent of capacity, while railroad operating income for February ran 188 per cent over the same month in 1933. Carloadings up 2.2 per cent for the week.

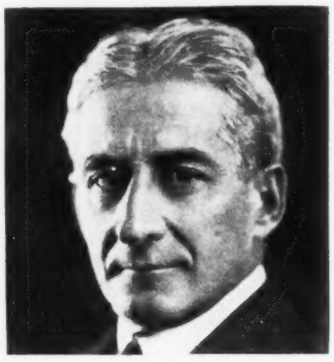
Prices separated in trend, stocks breaking sharply on news of presidential affirmation of a sharp-toothed exchange regulation bill, while bonds and commodities remained firm.

Ultimate disposition of the vast credit base set up by the government becomes the dominant problem. Unprecedentedly large, it could force an uncontrollable inflation.

Condemn Cities Service Curb Market Operations

Charges that Cities Service Company, through its subsidiary securities company, had bought and sold its stock on the New York Curb Exchange to maintain its value while having salesmen throughout the country selling stocks to individuals on the basis of curb quotations were aired late last week before the House interstate commerce committee by Robert E. Healy, counsel for the Federal Trade Commission. The hearing was in connection with the proposed stock exchange control bill.

Replying to the Washington statements, Cities Service Company asserted that there was nothing in Mr. Healy's testimony that was not explained by the company to the Federal Trade Commission a year ago. Maintaining that the security affiliate bought and sold stock of Cities Service to fill customers' orders, the company stated that "in the three-year period mentioned by Mr. Healy more than a billion dollars of securities was sold by some owners and bought by others than the Securities Company. Eighty million dollars merely represented the net amount of stock sold which produced capital for Cities Service Company. Any effect on stock prices of the buying by Cities Service Securities Company was purely the normal effect of public buying, since the company's purchases were merely an execution of customers' orders."



I am in entire sympathy with unemployment insurance, and, if it is possible, to have it nationwide.

Unemployment insurance, even at best, can only ameliorate the difficult conditions in which workers find themselves when unemployment comes. The first, basic, constructive thing to do, wherever possible, is to *assure* employment. Assurance is difficult, at all events at present, except where merchandise can be made up for stock which is not subject to rapid obsolescence or rapid changes in design and fashion.

The problem of unemployment insurance is being studied by commissions in several states. It would be desirable if federal legislation can make the burdens upon employees and employers in the various states more uniform. I suggest before the enactment of legislation along the line of that here proposed, desirable as its objective may be, that your committee continue its study.

GERARD SWOPE,
President General Electric Company.

In a statement last week before the House ways and means committee, holding hearings on unemployment legislation, Mr. Swope also cited examples of assurance and insurance within his own company.

Utility Investors Plan an Aggresive Program

Taking a definite stand with respect to political activities regarded as detrimental to fair values of utility securities and also with respect to actions or negligences of utility company managements, the American Federation of Utility Investors, Inc., is launching an aggressive program of action aimed to secure a fair deal for investors in utility securities. In announcing its program, the federation goes on record in favor of reducing excessive salaries and bonuses wherever they may exist; of uniform methods of accounting, and of annual reports prepared by independent auditors. It proposes to co-operate with government agencies and consumers and with the companies themselves in

the elimination of abuses wherever they may exist in the industry.

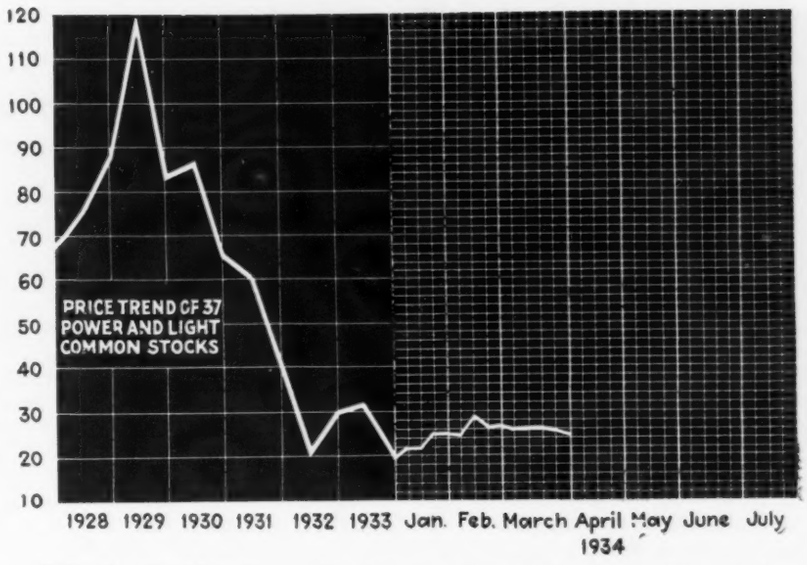
The program contains an appeal to the federal government to stop the future construction of all projects in competition with investor-owned utilities and loans to municipalities for duplicating investor-owned facilities "in direct violation of the NRA."

Preferred-Stock Holders Control Southern Iowa

Representatives of preferred-stock holders now dominate the management of Iowa Southern Utilities Company, following the recent annual election at which four directors were elected to represent the holders of preferred stock, dividends on which have been in arrears for more than a year. The directors are Dawson Brande, E. F. Bulmahn, Edward de Rivera and H. H. Polk. Two directors, George M. Bechtel and Harold R. Bechtel, were elected to represent the common-stock holders. Mr. Bulmahn was elected president to succeed George M. Bechtel.

Holders of Iowa Southern first mortgage 6 per cent bonds and of extended first mortgage bonds of the Burlington Railway & Light Company due on October 1, 1933, have deposited more than 80 per cent of the bonds of both descriptions under the plan to extend the issues to October 1, 1938, it has been announced.

Stocks Yield Ground



Following President Roosevelt's vigorous advocacy of strict regulatory legislation for exchanges, stock prices dipped. "Electrical World" index receded to 25.3 from 25.5 the preceding week.

Texas-Louisiana Power

Suit has been filed by holders of $14,400,000 of bonds of the Texas-Louisiana Power Company, now in receivership, for foreclosure against the properties of that company. In their petition to the federal court, the plaintiffs, Central Republic Trust Company of Illinois, and Arthur Leonard, trustee, state that $12,900,000 in bonds due January 1, 1946, and another issue totaling $1,800,000 due in 1960 had become payable because of default of $378,000 of interest January 1, 1933, and $49,500 interest March 1, 1933. Sale of the company's properties in Texas, Louisiana, New Mexico and Kentucky is asked.

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Northern States Power (Minn.)* (Year ended December 31)					
Gross earnings	$27,121,066	$28,354,160	— 4.3	64	62
Net earnings	9,795,098	10,631,401	— 7.9		
Net balance	6,151,318	7,152,452	— 14.0		
Philadelphia Electric (Year ended December 31)					
Gross earnings	60,813,494	63,775,369	— 4.6	49	48
Net earnings	30,113,817	30,330,293	— 0.7		
Net balance	19,601,069	19,635,041	— 0.2		
Southern California Edison (Year ended December 31)					
Gross earnings	35,251,630	37,158,391	— 5.1	35‡	31‡
Net earnings	22,838,808	25,493,428	— 10.4		
Net balance†	15,546,420	18,378,085	— 15.4		
Virginia Electric & Power (Year ended December 31)					
Gross earnings	14,648,481	15,428,448	— 5.0	66	64
Net earnings	4,952,275	5,570,017	— 11.1		
Net balance	1,870,748	2,498,518	— 25.2		
	1934	1933			
Alabama Power (Year ended January 31)					
Gross earnings	15,511,341	15,463,812	0.3	49	48
Net earnings	7,940,302	8,047,679	— 1.3		
Net balance	898,852	1,078,887	— 16.7		
Consumers Power (Year ended January 31)					
Gross earnings	25,947,939	27,568,174	— 5.9	55	52
Net earnings	11,554,216	13,293,564	— 13.1		
Net balance	2,821,072	4,513,707	— 37.4		
Detroit Edison (Year ended February 28)					
Gross earnings	41,987,222	42,777,162	— 1.8	69	72
Net earnings	13,006,313	11,871,541	9.6		
Net balance†	6,574,077	5,734,585	14.6		
Georgia Power (Year ended January 31)					
Gross earnings	22,132,029	22,249,118	— 0.5	50	49
Net earnings	11,064,247	11,446,355	— 3.3		
Net balance	2,001,213	2,273,912	— 11.9		

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Kansas City Power & Light (Year ending January 31)					
Gross earnings	$14,267,398	$14,717,428	— 3.0	60	57
Net earnings	5,679,350	6,376,189	— 10.9		
Net balance†	3,219,110	3,883,039	— 17.1		
Ohio Edison (Year ended January 31)					
Gross earnings	14,832,833	15,369,082	— 3.5	50	48
Net earnings	7,390,459	7,998,326	— 7.6		
Net balance	1,615,764	2,357,528	— 31.6		
Puget Sound Power & Light (Year ended January 31)					
Gross earnings	12,621,803	13,367,842	— 5.6	65	61
Net earnings	4,365,408	5,222,954	— 16.4		
Net balance	1,405,652¶	299,902	—560.0		
Tennessee Electric Power (Year ended January 31)					
Gross earnings	11,484,411	11,612,977	— 1.1	60	57
Net earnings	4,605,054	4,942,050	— 6.8		
Net balance	396,889	739,605	— 46.2		

Holding Companies

	1934	1933			
American Gas & Electric and subsidiaries (Year ended January 31)					
Gross earnings	$63,708,076	$64,432,124	— 1.1	61	58
Net balance	7,580,862	9,184,855	— 17.4		
Public Service Corp. of New Jersey and subsidiaries (Year ended February 28)					
Gross earnings	117,329,215	123,055,010	— 4.7	64	66
Net balance†	26,816,642	27,089,296	— 1.0		

*1933 figures preliminary. †Applicable to all dividends.
‡Operating expenses do not include depreciation. ¶Deficit.
Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

N.E.M.A. Price Call List Issued for 109 Products

In issuing its first formal list of 109 price calls, as of March 1, the published price list department of the National Electrical Manufacturers Association, code authority for the electrical manufacturing industry, anticipates that from 100 to 120 additional price calls remain to be posted. The March 1 list follows:

Appliance Products Subdivision—Water heaters, commercial dish washing machines, domestic electric heating appliances, fans.

Construction Material Subdivision — Manufactured electrical mica, molded insulation, vulcanized fiber products, laminated phenolic products, varnished fabric and paper, breaker strips, electrical porcelain, black phenolic radio tube bases, industrial brushes of carbon, brushplates.

Dry Batteries and Flashlights Subdivision—Dry batteries and flashlights.

Electric Tools Subdivision — Electric tools, classes A and B, flexible shafts, electric coal and mining drills.

Illumination Subdivision—Floodlighting equipment, industrial lighting equipment, airport lighting equipment.

Industrial Apparatus Subdivision—Welding apparatus, welding wire, classes A and B, welding wire, classes C and D, low-voltage generators and auxiliary equipment, transformers, type a.c. arc welders and auxiliary equip., fractional horsepower electric motors, general-purpose and special-purpose electric motors, synchronous electric motors.

Installation Devices Subdivision—Commercial doorbells and buzzers, door openers, glass tube fuses, non-renewable cartridge fuses, non-renewable plug fuses, renewable and multiple fuses, hospital signaling apparatus, interior fire alarm systems, experimental laboratory equipment, traffic signaling equipment, audible signals, contact devices, visible signals, municipal fire alarm equipment and police signaling equipment, panelboards, including enclosing cabinets, attachment plugs, flush receptacles, and connecting outlet devices, all types, switches, sockets, surface receptacles and rosettes, cutouts, cord sets, resale types, traffic actuated signaling systems, electrical sirens for use as audible signals, porcelain lighting fixtures.

Radio Receiving Tubes Subdivision—Radio receiving tubes.

Roughing in Material Subdivision—Rigid conduit, non-metallic flexible conduit, steel electrical metallic tubing, fittings: outlet boxes, switch boxes and conduit, outlet boxes, switch boxes, vapor-proof fittings.

Specialties Subdivision—Doorbell, toy and signaling transformers, luminous tube transformers and ignition transformers.

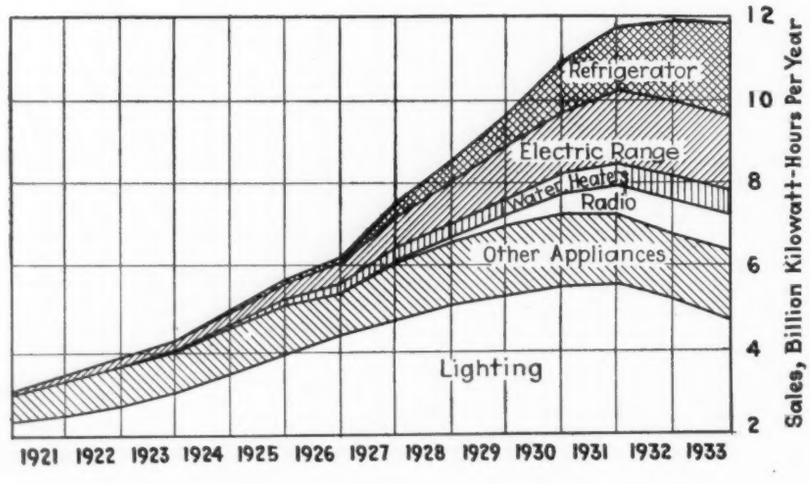
Telephone Manufacturers Subdivision—Telephone sets, instruments, parts, etc., telephone protective apparatus.

Transmission and Distribution Apparatus Subdivision—Underground fiber conduit and fittings.

Wire and Cable Subdivision—Flexible cord, rubber covered wire, electrical alloy —resistance wire, electric alloy—nickel magnet wire, bare and weatherproof wire, cord sets, custom built, armored conductor, armored lamp cord, lead covered armored conductor, flexible steel conduit, impregnated paper power cable, varnished cambric insulated wire and cable, twisted pair rubber covered wire, rubber power cable, replacement automotive wire and cable products, automotive wire and cable products, rubber sheathed cords and cables, armored service entrance cable, bunched copper strand, bare and tinned copper wire and cable, weatherproof iron wire, single conductor rubber covered wire, antenna wire and cable, flexible armature wire, non-metallic sheathed cable, coils, insulating compounds for filling cable-terminals, etc., braided and stranded copper wire, bare ground wire.

X-ray and Electromedical Apparatus Subdivision—X-ray products, electro-medical products, sunlamps, X-ray tubes and/or valve tubes, electrocardiographs.

REFRIGERATORS HELP ENERGY SALES



Expanding use of electric refrigerators was the most prominent factor in maintaining domestic energy sales in 1933, according to a compilation released by the Edison Electric Institute. The number of refrigerators in use increased by approximately 1,000,000 units during 1933, and contributed more than 500,000,000 kw.-hr. to the year's energy sales

Major New Construction This Week

Iowa Southern Utilities Company plans new transmission line in Wapello County.

Motors and controls, conveyors, etc., will be installed in addition to Clarksburg, W. Va., plant of Pittsburgh Plate Glass Company. Cost $125,000.

Seattle, Wash., will have $13,000,000 federal aid for city-owned Ruby and Diablo hydro-electric power plants of Skagit River power project, including transmission lines, power substations and switching stations, etc.

Three Diesel engine-generator units and complete accessories, two 250-hp. watertube boilers with stokers and auxiliary equipment, compressors, refrigerating machinery, hoists, conveyors, motors and controls, etc., will be purchased for brewery of Adolph Busch, Inc., St. Louis, Mo. Complete plant will be electric-operated. A $1,000,000 project.

Until April 4, United States Engineer Office, Kansas City, Mo., asks bids for electrical distribution system at construction camp, Fort Peck power dam project, Missouri River, near Glasgow, Mont., including poles, transformers, wire and cable, lighting units, floodlighting, etc.

Corning, Iowa, has rejected bids recently received for equipment for new city-owned electric light and power plant and electrical distribution system. New bids to be asked, including three Diesel engine-generator units and accessories. Fund of $160,000 arranged.

Motors and controls, transformers and accessories, regulators, air compressors, electric hoists, etc., will be installed in new plant at Monroe, La., of General Carbon & Chemical Corporation, Dallas, Tex. Cost $150,000.

Tivoli Brewing Company, Detroit, Mich., has approved plans for six-story addition. Cost over $100,000.

Glenwood, Minn., has called special election April 17 to approve bonds for $140,000 for city-owned electric light and power plant.

Federal Insulator Order

Four carloads of "Pyrex" suspension insulators and accompanying line hardware will be shipped by Corning Glass Works for Western projects. Three carloads will go to the Bureau of Reclamation, Denver, for use on the Casper-Alcova line, while the fourth carload is to be shipped to the Montana Power Company.

New York Metal Prices

	Mar. 20, 1934 Cents per Pound	Mar. 27, 1934 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.65	7.625
Nickel ingot	35.00	35.00
Zinc, spot	4.725	4.675
Tin, Straits	53.60	54.625
Aluminum, 99 per cent.	23.30	23.30

MEN OF THE INDUSTRY

JOHN D. GAREY, chief engineer of the New Brunswick Power Company, Ltd., St. John, N. B., has been elected president of the Association of Professional Engineers of New Brunswick.

FRANK J. SAWYER of Grand Blanc has been named a member of the Michigan Utilities Commission by Governor Comstock. This is the Governor's second appointment to the commission, the other being the new chairman, James B. Balch.

E. KENT HUBBARD, industrialist of Middletown and president of the Manufacturers' Association of Connecticut, was elected a director of the Connecticut Power Company. C. Hadlai Hull, New London attorney, has also been elected to the directorate.

LOUIS RUTHENBURG has been elected president of Servel, Inc., to succeed H. H. Springford, who is being retained in an advisory capacity on a basis which will leave him free to devote time to other interests. Mr. Ruthenburg became identified with the refrigeration industry in 1929, when he resigned as vice-president of General Motors Truck Company to assume the presidency of Copeland Products, Inc.

RICHMOND B. KEECH, for the past four years People's Counsel, Washington, D. C., has been appointed a member of the District of Columbia's Public Utilities Commission by President Roosevelt, to fill the vacancy caused by the recent resignation of Chairman Mason M. Patrick. Prior to his service as People's Counsel Mr. Keech was for five years Assistant Corporation Counsel.

R. F. FISHER, formerly sales manager of Triplex time switches for the Triplex Products Corporation, is now identified with the Mercoid Corporation as one of its vice-presidents in charge of sales. The Mercoid Corporation manufactures automatic controls for pressure, temperature and vacuum used on heating, refrigeration, air conditioning and industrial applications.

JOHN MACFARLANE KENNEDY, a partner in the firm of Kennedy & Donkin, consulting engineers, has been appointed a member of the British Electricity Commission. Mr. Kennedy will serve as chief technical member of the commission, devoting special attention to the problems of distribution. He is a vice-president of the Institution of Electrical Engineers and adviser to the northern Ireland government on its scheme of electrical distribution. He will take office next July. W. W. LACKIE will retire from the commission at that time.

W. C. PITFIELD of Montreal has been elected chairman of the board of directors of Eugene F. Phillips Electrical Works, Limited, and J. B.MCCARTHY, also of Montreal, has been appointed vice-president in charge of sales.

R. O. SWEEZEY, one of the original promoters of the Beauharnois Power Company, has been elected to the board of the Lasarre Power Company, Limited, of Lasarre, Que. This company is launching out on an extensive program to supply the Northern Quebec mining area.

W. L. PERCEY, vice-president of the Southern California Edison Company in charge of corporate contracts and documents, retired from active duty recently after nearly forty years of continuous service. Mr. Percey became identified with the electrical industry in southern California in 1896 as an employee of the old West Side Lighting Company. He held many offices in the course of his association with the Edison company.

FRANK A. NEALON has been appointed general sales manager of the American Enameled Magnet Wire Company, Port Huron, Mich., manufacturer of magnet wire in all insulations, automotive cables, radio, transformer and antenna wire and coils. Mr. Nealon was formerly sales manager for the Sterling Cable Corporation and has had considerable experience in the selling, advertising and merchandising of automotive cable and wiring.

GORDON FOX, since 1920 power and electrical engineer of the Freyn Engineering Company, steel mill consulting engineers in Chicago, has been elected vice-president of that organization. The past five years Mr. Fox has spent largely in U.S.S.R., where the Freyn Engineering Company, in association with the Russian organization, Gipromez, has cooperated in the development of the steel industry of the Soviet Union. Following graduation from the University of Wisconsin in 1908, Mr. Fox was associated with the General Electric Company in several capacities until 1914. He is the author of many articles which have appeared in the technical press and has written two books dealing with motors and control for industrial equipment. Mr. Fox is a member of the American Institute of Electrical Engineers, the Association of Iron and Steel Electrical Engineers and the Western Society of Engineers.

OBITUARY

William S. Lee

William States Lee, vice-president and chief engineer of the Duke Power Company, Charlotte, N. C., died at his home in that city March 24, of a cerebral hemorrhage. Backed by the fortune of the late James B Duke, the great tobacco magnate, Mr. Lee produced a

high-voltage hydro-electric power development and transmission system which, industrially speaking, revolutionized the South, especially the Carolinas, where water-power development had been mostly local in scope. It was in the building of the Catawba River plant near Rock Hill, S. C., that the association between Mr. Lee and Mr. Duke was formed. Taking over the Catawba project after three disastrous efforts to place a dam across the river, Mr. Lee in seven months had completed the task. It was in the beginning of this superpower zone in 1904 that Mr. Duke's financial aid was first volunteered. Mr. Lee's most notable achievement followed, the designing and building of the Duke Power Company system, consisting of 32 hydro-electric stations and seven electric stations, generating more than 1,000,000 kva.

In addition to his connection with the Duke Power Company Mr. Lee was vice-president and chief engineer of the Catawba Power Company, Great Falls Power Company, Western Carolina Power Company and other Carolina properties, as well as president of the W. S. Lee Engineering Corporation.

Mr. Lee was a past-president of the A.I.E.E. and of the American Engineering Council and held membership also in the A.S.M.E., A.S.C.E. and other similar associations.

Major William J. Hammer

Major William J. Hammer, U.S.A., retired, distinguished engineer and scientist and one of the early associates of the late Thomas A. Edison, died March 24 in New York in his seventy-seventh year. Mr. Hammer, who was president of the Edison Pioneers in 1920, maintained consulting electrical engineering offices in New York City from 1890 to 1918, when he assumed war duties for the government.

Mr. Hammer entered the employ of Thomas A. Edison at Menlo Park in 1879 and subsequently became chief engineer of the Edison Lamp Works. In 1881 he was sent abroad by Mr. Edison and, as chief engineer of the English Edison Electric Light Company, built in London the first incandescent lighting system of the metropolis operating from a central generating plant. He also served as chief engineer for the German Edison Company. Returning to this country in 1884, he became secretary of the Sprague Electric Railway & Motor Company and was appointed manager and chief engineer of the Boston Edison Company in 1886. Mr. Hammer was connected with many other important developments of early electrical days and was in charge of the extensive Edison exhibit at the Paris Exposition of 1889. Since that time he had devoted his time to private practice.

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MURRAY J. IDAIL, chief engineer of the Virginia Public Service Company since 1928, died in Alexandria, Va., March 10. Mr. Idail was born in Baltimore, Md., in 1897. He was graduated from Catholic University in electrical engineering in 1917. He supervised and directed some of the most important development and construction work carried on by the Virginia Public Service Company.

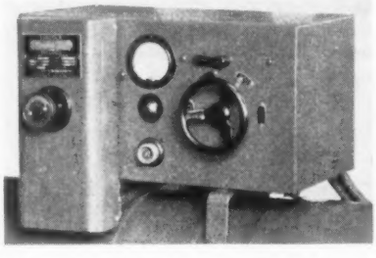
MAJOR-GEN. GEORGE O. SQUIER, retired, discoverer of the principle of "wired wireless" and of numerous other developments in the art of communication, died, of pneumonia, March 24 in Washington, D. C., in his seventieth year. General Squier, who directed the air and signal services of the American army during the World War, had won a high position in the field of science as applied to military activities, when he retired in 1924. Of his many inventions the best known is his "wired wireless," which includes multiple telephony, wireless telephony, long-distance telephony and practical telephony. Although developed for military uses, it has also been applied commercially. Included in his researches were electrochemical effects due to magnetization and the absorption of electromagnetic waves by living vegetable organisms. He was a fellow of the Physical Society of London, a member of the National Academy of Sciences and of other scientific societies and held the Elliott Cresson gold medal, the John Scott medal and the Franklin medal for his researches.

GEORGE W. WOODRUFF, a member of the Pennsylvania Public Service Commission, and a distinguished figure in the political life of that state, died March 23 at Harrisburg after a week's illness. He was 70 years of age. More than thirty years of his life had been passed in public office, which included terms as Attorney-General of Pennsylvania, as United States District Judge in Hawaii, as Assistant Attorney-General for the United States Department of the Interior and for five months as acting secretary in President Roosevelt's famous "Tennis Cabinet." On his own initiative, Mr. Woodruff developed the method of adjusting rates at informal conferences with the officials of the utility companies rather than by formal decisions and court orders.

NEW EQUIPMENT

Arc Welder Remote Control

Impulse-operated remote-control equipment for arc welding machines said to give higher quality welds, increased weld output and savings up to $500 per year per welder have been introduced by the Lincoln Electric Company, Cleveland, under the name "Lincontrol." The equipment requires no additional



cables or other apparatus to be carried by the operator. Operating impulses are made by tapping the electrode on the work several times to raise the voltage automatically; a larger number of taps and the voltage is lowered. These make-and-break impulses can be made at any distance from the machine, without making trips back and forth to adjust the controls. Lincontrol is offered as optional equipment with Lincoln welders and may be purchased separately and installed on motor-driven, belt-driven or gasoline welders already in use.

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LOW-VOLTAGE INSULATING COMPOUND, offered as highly efficient for insulating joints operating at 600 volts or less, has been introduced by the General Cable Corporation, 420 Lexington Avenue, New York City, as another compound in its Ozite series, familiar for higher voltage service. It does not bond itself tightly to either metal or insulation so it can, therefore, be removed for the making of circuit alterations.

PORCELAIN INDICATING CUTOUTS which have neon lamp indicators built in permanently and indicate a loose or blown-out fuse even though there is no load on the circuit are announced by the L. S. Brach Manufacturing Corporation, Newark. "Fuse-O-Lite" cutouts are available for standard circuits in both plug and cartridge types. Cutouts use any standard fuses; indicating lamps have long life, use no measurable current and are unaffected by short circuits or current surges.

Production Seam Welders

For mass production of straight or circular seam welding of ferrous metals, corrosion-resistant steels and, with slight modifications, non-ferrous metals, the Thomson-Gibb Electric Welding Company, Lynn, Mass., has announced its "1,000 Series" seam welder. Knurl or friction drives provide constant welding speed regardless of welding wheel wear, and means are also provided for maintaining constant welding pressure. A highly efficient cooling system is provided and a current-interrupting device permits a variety of production conditions. Application range also permits handling objects from 10½ in. in diameter and 12 in. in length to 40 in. in diameter and 45 in. in length at welding speeds from 2 to 15 ft. per minute and pressures from 650 to 1,400 lb. Size of transformer furnished depends on the work.

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INDUSTRIAL FREE-WHEELING CLUTCHES for connecting two prime movers to a load so that either can pull the load but neither can drive the other have been offered by the Morse Chain Company, Ithaca, N. Y., a division of the Borg-Warner Corporation. Morse-Kelpo clutches are positively actuated in one direction without backlash and free-wheeling in the other. They permit dual motor drive, motor and turbine drive, booster drives such as for starting steel and paper mill machinery or printing presses, etc.